II: 8

The Largest Agricultural Limestone Producers

USE

The Bradley Three Roll Mill

This mill is in use by more large producers than any other machine made—produces more material and at a lower cost.

No auxiliary machinery or screens needed to procure the very finest finished product—takes rock ¾" in diameter and reduces to shipping fineness in single operation.

The Demand for Finely Ground Limestone Is Increasing. Why Not Prepare Now?

Send for Catalog No. 42—Our Engineering Dept. Is at Your Service

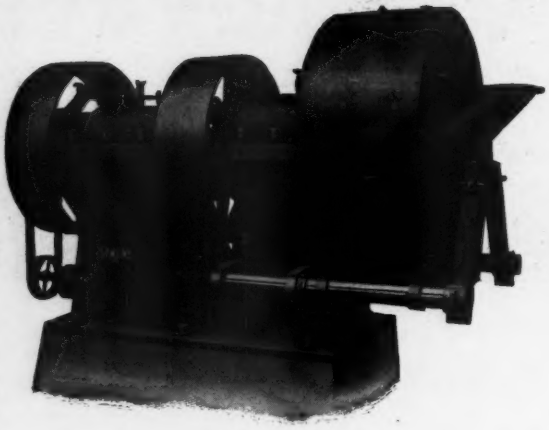
Bradley Pulverizer Co.

BOSTON **London** **Works—ALLENTOWN, PA.**

JULY, 1918

Table of Contents - - Page 17
Index to Advertisements - Page 17

SYMONS DISC CRUSHER



READY FOR IMMEDIATE DELIVERY

Questionnaire Sent to All Users, and One of the Answers

Q. Size crusher this report covers? Ans. *48 inch.*
Q. Kind of material crushed? Ans. *Limestone.*
Q. What moisture in material? Ans. *No Record.*
Q. How long have you operated crusher? Ans. *3 years.*
Q. What is size of feed? Ans. *4 inches.*
Q. What is size of product? Ans. *1½ inch.*
Q. What horsepower does it require? Ans. *65.*
Q. How many tons per hour does it crush? Ans. *80 to 100.*
Q. How many tons do you crush per pair of discs? Ans. *750,000 tons.*
Q. What percentage of time have you lost on account of breakage? Ans. *None.*
Q. Give your opinion of this crusher as compared to rolls. Ans. *Would not use rolls.*
Q. Give your opinion of this crusher as compared to a jaw crusher. Ans. *Superior to Jaw crusher.*
Q. Give your opinion of this crusher as compared to a Gyratory crusher. Ans. *Superior to Gyratory crusher.*

Signed *Name on Request.*

Many more like this, also reports of the success of the crusher on different kinds of material.

Also built in sizes 18 in., 24 in. and 36 in.

Manufactured and Sold Only by

Chalmers & Williams

CHICAGO HEIGHTS, ILL.

Pit and Quarry

Vol. 2 Chicago, Ill., July, 1918 No. 8

PLANT OF THE LOUISVILLE CEMENT CO. AT MILLTOWN, IND. ROCK CRUSHER ON THE HIGH SIDE OF THE HILL AND SCREENING HOUSE OVER THE LOADING TRACKS. MACHINE SHOP IN THE FOREGROUND AND POWER PLANT IN THE BACKGROUND.

Works Two Qualities of Stone

Speed's Quarries Produce Material for Crushed Rock, Agricultural Limestone, Lime, Portland and Natural Cements and Cement Mortar

By A. W. Williams

ONE OF THE MOST modern plants in the central West is that of the Louisville Cement Company's stone plant at Milltown, Ind., which manufactures crushed rock, ground agricultural limestone, burned lime, etc., cement manufacturing being conducted at the other plants at Speed's, Ind. The Milltown plant has now been in operation for about five years—that is, the new plant which took the place of one that had been in operation for a number of years—while one of the older plants is still operated as an emergency mill principally. The J. B. Speed Company, of Louisville, is sales agent for the output of this plant, as well as those at Speed's.

TWO QUALITIES OF STONE

The large quarries are located on a high hill and are divided into two benches, there being about a 150-foot fall. The upper bench produces low calcium stone for crushing, its depth

being about 65 feet, while the high calcium stone on the lower bench is about 85 feet lower. The former is shunted on a direct level to the crusher plant, while the latter is hand sledged, picked and loaded on small trams which are transferred by mule and cable to the lime kilns, which are about 2,000 feet from the crusher, and on a lower level.

This lime plant is equipped with two No. 2 gas producer kilns, the largest in the country, and have a capacity of 1,250 bushels each for every twenty-four hours. The rock as brought in on the cables is dumped into a large bucket, which holds a number of trams, and this is automatically hoisted to the tower and dropped. This mill is operated by electricity from the main crusher plant.

In addition to the main crusher plant and lime plant the old relief plant has a fair capacity, and is equipped with three old-style vertical kilns, this entire plant also being operated by electricity from the company's main power plant. The main crusher plant is operated by direct drive, direct from the power plant to the crushers, while the screen house is operated by electricity.

Equipment

Reaching the rock stratas is a bit difficult in these quarries, due to the roughness of the land, which makes the ordinary stripping process hazardous. Instead of stripping with steam shovels the company removes from 1 to 10 feet of earth by means of hydraulic pressure, the pipe having a 175 pound nozzle pressure, and driven by a Dean pump. Drilling is handled with cyclone well drills and Ingersoll tripod drills. One steam shovel is used in the crusher quarry, this being a Marion 75. Two locomotives, one a Vulcan and the other a Porter, both narrow gauge, and forty 6-yard Continental cars are used in transferring material from the crusher quarry to the crusher, which is on the same level.

All told, the company has about five miles of railroad, including narrow and standard gauge tracks. Two bridges were built in order to bring a standard gauge track in from the Southern railroad for loading out lime and crushed rock, the company not operating any standard gauge equipment, and using Southern cars, pulled from the private spur by Southern engines.

Crushing House Below Quarry Floor

The crushing operations in this plant are fairly simple. The rock comes in on the quarry level at the top of the crusher plant, which is built on the side of the hill so that the material works down through the plant largely by gravity from elevation to elevation. The rock is dumped from the trams directly into a No. 12 Gates crusher, passing through a sixty-inch screen and going to a No. 7½ or No. 5 Gates crusher, according to the size wanted. The screen used in the crusher house is a 60-inch, in three sections, while two 40-inch screens, each in two sections, are used in the screening house, which is a short distance from the crusher. These screens are all Allis-Chalmers, and a No. 2 pulverizer of the same make is found in the crusher plant for manufacturing ground limestone.

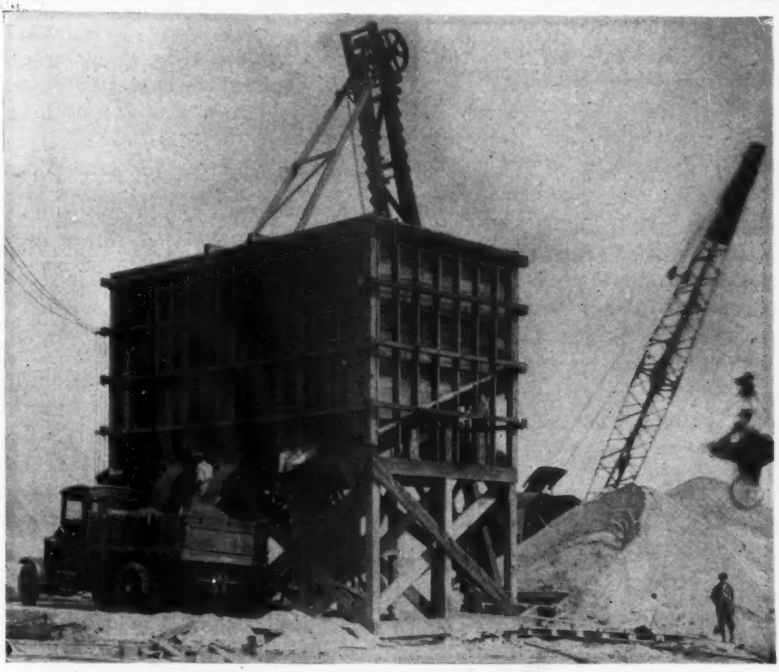
Compressed Air Operates Stone Spouts

From the crusher the stone is carried to the screen house by a covered-ever belt conveyor, this belt being 32 inches wide and 120 feet from center to center; that is, from the crusher to the screen house. The conveyor equipment is of the well-known Robbins make. The screen house is of concrete and corrugated iron, while the entire plant is of the same construction. However, concrete enters strongly into the construction of the

screen house, which is built high enough to allow two loading tracks to enter under the lower screen, so that rock may be dropped directly from the bins to the cars on the track. Instead of operating the hopper drops by hand, as is the rule in most plants, these drops are operated by compressed air, which is a safer and quicker method of opening and closing.

Power Plant

The power plant is equipped with boilers in two units, one unit being 250 h. p., while the other is of 200 h. p., using Babcock & Wilcox boilers. Two engines capable of a total of 425 h. p., are in service, one of these being a 350 h. p. Hamilton Corliss, and the other a 75 h. p. Buckeye. The generator is a 350 K. W., made by the Allis-Chalmers company. A large Laidlaw, Dunn & Gordon air compressor is operated in the power plant to furnish compressed air for the drills and also



For Better Service

UNLOADING its boat with a clamshell bucket and using the same machine to load motor trucks didn't seem to be the right thing to do. It cut down the efficiency of the system, for the Lake Sand & Gravel Co., Detroit, Mich., is always in the vanguard of progress. So a four-in-one storage bin was built and a loader bearing an endless chain of steel buckets installed to keep the bins filled. The picture tells the rest. Now if the clamshell does any second-handling work, it is when loading trucks in addition to those being loaded at the bin. Acknowledgment is given the Federal Motor Truck Co. for the use of the picture.

for the valves operating the hoppers in the screen house.

Runs Own Commissary

The crusher plant has a capacity of 1,200 tons of rock every ten hours. A total of 150 men are employed on an average. The company operates a small industrial city of its own, having built homes for its employes in much the same way as mining concerns and large lumber concerns build homes for workmen, while it also runs a commissary or general store for the benefit of its employes.

Outside of the relief plant and lime plant five buildings are bunched at the crusher, these consisting of the crusher, screening house, power plant and machine shop and blacksmith shop, the two latter adjoining and connecting, while the others are placed far enough apart to prevent any chance of fire spreading from one building to another, although there is very little wood used in their construction. On the south side is the crusher, the screen house being on the north, the power plant to the east and the mechanical buildings on the west. The blacksmith shop and machine shop are very important divisions of the operations, and are equipped to handle almost any sort of work except welding, which is sent over to the plant at Speed's.

Separating the high calcium rock for lime burning entails considerable handwork in sledging out to the proper sizes, hand-picking, etc., so that only the best grades are sent to the kilns. However, the fact that one section of the quarries runs considerably higher in calcium stone makes this comparatively easy. Again, the high calcium rock is in the lower level, and close enough to the kilns to make a very short haul, which is started by mules, the cars being hooked to a cable at the entrance to the quarry.

Keeping Men on the Job

Keeping men on the job is no easy matter in an isolated village district. It is impossible to keep the men from going to the larger towns on pay day, but by keeping liquor out of the camp things are made much better, and this is possible where a company owns all the land near the village, and is enabled to keep bootleggers out.

Effect of the Freight Rate Increase

TO ADD ACCEPTANCE of the freight rate increases on sand, gravel and stone called for in General Order No. 28 would seriously cripple those industries. Many plants might be put out of business, because all are producing a low-priced material at small profits, and freight rates are of equal importance with efficient plant operation and general management. The recent 15 per cent advance was about all the contractors could stand; the new increase amounts to 40 to 70 per cent, because of the average short haul.

Director-General McAdoo has put acceptance of the June 25 increase as a patriotic duty. Producers of these materials are by character 100 per cent patriotic and as a whole have suffered severe loss of business because of the war, in order to keep their organizations intact in the face of decreased markets and greatly increased expenses. The general sentiment is one of helplessness. In a patriotic way operators feel that they could render more substantial aid to the conduct of the war if allowed to do business under war rulings that offer

Freight Rate Advance.

GENERAL ORDER NO. 28 provided for a 25 per cent increase which took effect June 25 on all commodities in general, but road building and other heavy materials are given special treatment, the advances being as follows:

Stone, natural or artificial, for building purposes, 2 cents per 100 pounds.
Stone for road work, sand, gravel, 1 cent per 100 pounds.
Brick, cement, and plaster, 2 cents per 100 pounds.
Lime, 1½ cents per 100 pounds.
Coal, 15 to 50 cents per ton.
Coke, 15 to 75 cents per ton.
Iron ore, 30 cents per ton.

a fifty-fifty chance for existence rather than by shutting down or delivering on present contracts at a loss.

It certainly is not the aim of the government to impose undue hardships upon the production of materials so necessary as sand, gravel and stone, so that it is most likely in issuing the rate advance order, the conditions in these industries were not understood. Believing this, the producers, through their state and national associations, have sought to enlighten the government's departments in the hope that a postponement or suspension of the order will be made. The resolution adopted by the Ohio sand and gravel organization is typical of many others sent to Washington and is here reproduced:

RESOLVED, by the members of the Ohio Sand and Gravel Producers' Association at a session thereof held at Columbus, Ohio, June 4, 1918, that with due regard to the demands made by the national emergency on individuals and industries to accept grave and unusual burdens, we are earnest in our conviction that a freight increase so drastic as to be in effect prohibitory can hardly be justified; that when such increase is relatively immoderate, comes unheralded and does not take into consideration existing contracts, it is in effect fatal to industries already staggering under the exactions of war.

RESOLVED, that it is not fair to an industry which has patriotically responded to every call of the Government in the purchase of Liberty Bonds, War Saving Stamps, Red Cross, Y. M. C. A. and K. of C. contributions, in the payment of all taxes, to overwhelm it with an additional tax under the guise of prohibitive transportation charges. Be it further

RESOLVED, that the imposition of a flat twenty-cent per ton increase on sand and gravel, recognized as a wartime essential by the government in its preferential ruling, involving as it does the least hazard to the carrier as well as the least attention, is unfair when compared with less increases on other commodities involving greater hazards. And be it further

RESOLVED, taking in consideration of the fact that the average haul of sand and gravel is short, the flat twenty-cent per ton increase, added to the so-called fifteen per cent increase, is in effect practically a one hundred per cent increase. Be it further

RESOLVED, that the secretary spread this resolution upon the minutes of the Association and send copies thereof to the United States senators from Ohio, to such congressmen as would be interested therein, to the U. S. Railroad Administrator, and to the Interstate Commerce Commission.

The advance was made solely to assist in the much needed increase in railway earnings. The movement to control commodity markets is spreading and government domination of production and distribution, and of prices, is the outstanding business feature.

On July 10 protests will be heard in the office of L. W. Page, Director of Public Roads, by a committee of which Mr. Page will be chairman. State highway officials, contractors and material men have been asked to be on hand with figures showing how the increase will affect present contracts. Secretaries E. Guy Sutton, of the National Association of Sand & Gravel Producers, and A. P. Sandles, of the National Crushed Stone Association, will be present. In Ohio alone the advance will cost contractors approximately $1,000,000 and will drive many into bankruptcy.

VERY GLAD to get PIT AND QUARRY and enjoy reading it very much.—Champion Sand & Gravel Co., Denver, Colo.

Fig. 1—Stone is dumped on railroad iron grating having 14-inch squares. Short conveyor handles ballast material; long one feeds to screening machine shown in picture below.

Fig. 2—Double strand roller chain screening machine drags stone over tapered screen bars, for the purpose shown in picture on the opposite page.

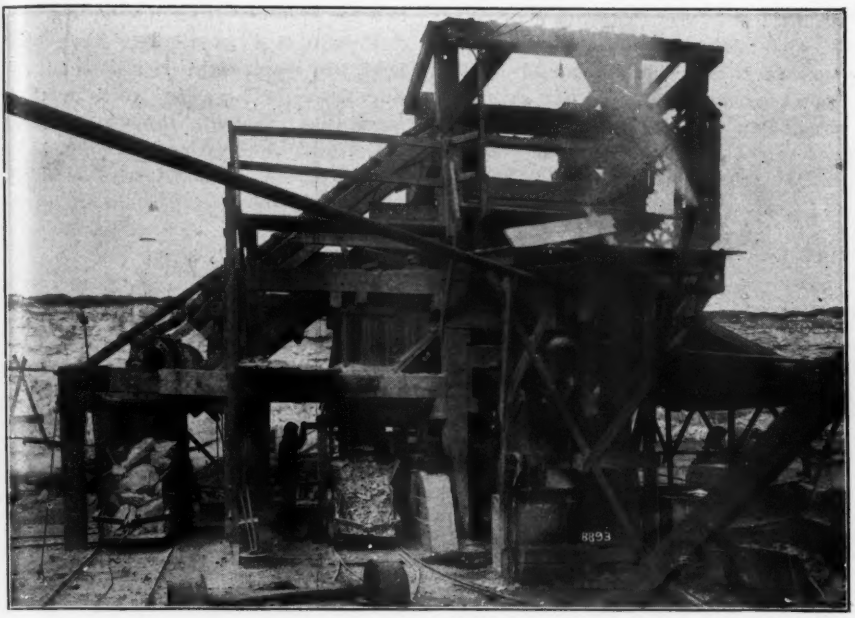


Fig. 3—Bin under tapered screen bars receives material under five inches, which goes to crushing plant. Larger stones, rejected by bars, go to the lime kilns.

Stone for Two Uses Is Sorted and Screened by Machinery

Thomasville Crushing Plant and Lime Kilns Have Rock Separating Arrangement Embracing Several New Features.

NEW FEATURES in the design of the Thomasville Stone & Lime Company's plant at Thomasville, Pa., include the separation by machinery of the large stones, which are fit for the lime kilns, and screening out of the small stuff for the crushing plant or for ballast. The three pictures show a stone-sorting or screening arrangement that is unusual in connection with quarry work.

Figure 1 shows a grating onto which the stone is dumped by quarry cars and on which it is fiedged by hand to reduce some of the extra large pieces to a size to pass through the 14-inch squares in the railroad iron grating. The stone is then drawn from a large steel-lined hopper out to two inclined pan conveyors. The left-hand or short one delivers a load of a grade of stone that is used for ballast and crushed stone work.

The long pan conveyor feeds to a double-strand roller chair screening machine, which is illustrated in Fig. 2. This machine drags the stone over tapered screen bars which can be seen in about the middle of the picture, and delivers stone under four or five inches to a small bin. The larger stone passes over the grating and is eased down an incline and delivered with a minimum drop to the skip car shown

at the left of Fig. 3. This view (Fig. 3) also shows very clearly the difference in the product delivered by the screening machine. The two skip cars are shown ready to run up the incline, one to the lime kilns and the other to the crushing plant.

Changed from Hand-Loading

The feature of this plant was the change from hand-loading of cars to small steam-shovel work, and the number of pieces of stone larger than 14x 14 inches run small enough, in proportion, to enable them to spread economically on the grating for delivery to the pan conveyors. The rapid filling of the skip cars also speeds up the production to the lime kilns and crushing plant, and the storage capacity of the large hoppers into which the quarry cars dump, together with the amount of stone carried on the pan conveyors, insures an ever-ready supply to the skip cars leading to the plant.

This plant has been in operation day and night for about 2 years and is still in excellent condition, due to the very heavy proportioning of all moving parts and slow speed of the moving parts.

It was designed and built by the Link-Belt Company, of Philadelphia and Chicago.

Oil and Coal Products in Road Work Limited.

PETROLEUM, asphalt, or tar products wanted for the construction, maintenance, or reconstruction of roads will be delivered only after approval of the application by a committee representing the United States Fuel Administration and the Office of Public Roads of the United States Department of Agriculture. This announcement is made by officials of the two Federal agencies.

State highway departments, to which notices of the restrictions have been sent, are required to pass upon all applications for highway work in their territories involving the use of these materials. Applications are then to be sent to L. W. Page, Director of Office of Public Roads, Washington, D. C. Mr. Page is chairman of the committee which will consider the necessity of the material being supplied and will make recommendation.

The government's action is not intended to restrict maintenance work, but rather to provide against deterioration of roads that will soon be improved on a vast scale leading to government warehouses.

Council Will Control Road Work.

ROAD AND STREET work in future will be controlled by the United States Highways Council. This body will seek to prevent delays, financial losses and uncertainty in taking up each highway problem in its turn with a separate government agency. It will keep in close contact with each state highway department. All highway projects in which the government is interested will be taken up through the state commissioners.

The council consists of L. W. Page, U. S. Director of Public Roads, chairman; Col. W. D. Uhler, war department; C. G. Sheffield, Fuel administration; G. W. Kirtley, Railroad administration; R. L. Humphrey, War Industries administration, and J. E. Pennypacker, secretary.

It urges conservation of money, tranportation, labor and materials in the following rank of importance: Maintenance of existing streets and roads; reconstruction of badly damaged streets and roads, and new construction only where vitally necessary.

Agricultural Ground Limestone

BY RICHARD K. MEADE

Chemical and Industrial Engineer, Baltimore, Md.

This Isn't a Cotton Field—It Takes Limestone to Grow Clover Like This

—Courtesy of College of Agriculture, The Ohio State University.

WHERE LARGE PULVERIZED stone operations are to be undertaken, a report on the deposit should be made by a competent expert. Such a man can advise as to not only the quality of the beds but the quantity available and make suggestions as to the proper working of these to obtain the best product. He can also advise as to the legal requirements for the sale, commercial possibilities of the plant, etc.

Equipment Necessary

Coming to the question of the equipment necessary to produce agricultural ground limestone, a large variety of crushers, mills, etc., are available for this. Usually the preparation of this product will be in two stages, (1) crushing and (2) grinding, although there are mills advertised which will take stone which has been broken down to hand size with a sledge and reduce this directly to a fair product. These mills are, however, only intended for small outputs, and when a well-equipped plant is desired which will turn out a good product economically, the process can be most efficiently conducted in two or more stages.

The mills most used for the preparation of ground limestone are hammer mills, Fuller-Lehigh mills, Griffin mills, Raymond mills and ring roll mills. Probably the most popular installation for the preparation of agricultural ground limestone is a hammer mill. The stone is first passed through a crusher of either the jaw or gyratory type and reduced to pieces from 2 to 2½ inches and under. If desired, the rock may be screened and

only the 2-inch stone used, but this is not necessary. The product of the crusher is then elevated into a bin and fed from this to the hammer mill, or it may be fed directly from the elevator leading from the crusher into the mill if the quantity so fed is regulated to suit the capacity of the mill.

The Hammer Mill

The hammer mill is manufactured by a number of concerns each of whom has some particular modification of the type. In general, the mill consists of a series of short, flat bars or hammers hinged around a central shaft, which hammers swing out as the shaft revolves and beat the material to pieces against grinding plates set around the circumference of the mill. The fully ground material falls through a grid in the bottom of the mill and the fineness is regulated by the spacing of the bars composing this grid.

The product of most types of this mill needs no other screening than this grid. However, a finer and more uniform product can be obtained from all of them by screening and returning the tailings to the mill for grinding. The hammer mill is well suited to grinding to a fineness of ten mesh but is not adapted to giving a fine material. The principal advantage of the hammer mill is that it may be fed with coarse rock and will reduce the same to a finished product.

The Griffin Mill

The type of Griffin mill usually employed for preparing ground limestone is the three-roll Griffin, although where small outputs are desired a single-roll Griffin may be used to advantage. The three-roll Griffin mill consists of three rolls suspended from the cross yoke of a central vertical shaft. This latter is hung from an "A" frame and is revolved by means of a horizontal pulley. When the mill revolves, these rolls swing out against a horizontal ring or die and the material is ground in between this ring and the rolls.

When ground it is sucked up by fans attached to the shaft and blown through a screen, after which it falls down into a chamber below the mill foundation, from which it is conveyed by suitable means. The fineness of the product depends on the size of screen employed, and a product of any fineness from all passing a 10-mesh screen to one of 95 per cent passing the 100-mesh screen can be obtained.

The single-roll and smaller size three-roll Griffin mills require that the stone shall be reduced to approximately ¾-inch stone and under. There is a large three-roll Griffin mill ("Hercules") which will take larger material and reduce to 55 per cent passing the 100-mesh screen, but the output of the latter is probably far in excess of that needed by the quarryman, being about 40 tons per hour.

The Fuller-Lehigh Mill

The Fuller-Lehigh mill consists of a die or ring mounted on a suitable casting, against which four balls are made to revolve by means of pushers. The material is ground between the balls and die. The ground material, as in the case of the Griffin mill, is sucked up by means of fans and blown out through screens into a casing, from which it is discharged by a sweep. The Fuller-Lehigh mill may be obtained in a number of sizes and almost any fineness of product desired may be obtained by altering the screens. The material fed to the mill must be first crushed to about ¾-inch and under, depending on the size of the mill—the larger mills taking coarser feed than the smaller ones.

The Raymond Mill

The Raymond mill consists of four or five rolls which are suspended from a central vertical shaft with cross arms. These rolls are swung out against a ring or die by means of the revolutions of the shaft and the material is ground in between the die and rolls. The finely ground powder is sucked up by means of an exhauster and blown into a cyclone dust collector, where the fine powder settles out of the air and is discharged from the bottom.

Fineness is regulated by the draft of air through the cone. The Raymond mill also requires the material to be crushed to ¾-inch and under before being fed to it. This mill is well adapted to giving fine product but can not be made to give the coarse 10-mesh material.

Road Repairs Necessary to Help Country.

If a "penny wise, pound foolish" policy is adopted—particularly in so far as road repairs are concerned—it will mean that for every dollar saved ten will have to be spent to make up for the destruction that will go on and which will increase alarmingly.

In caring for highways—used now ten times as much as they were a year ago—nothing could fit the case so well as "a stitch in time saves nine."

Unless liberal road repairs are permitted all over the country many highways will be almost beyond use before the summer is over, and they will be absolutely of no avail when winter comes.

What Is Necessary

In order that the roads may not be entirely destroyed or put into a condition requiring complete rehabilitation, the government ought to impress upon states, counties, cities, townships and villages the necessity and desirability of eliminating every mudhole, every depression, by filling in; it should ask that culverts and bridges be kept in a reasonable state of repair, and it should command that every highway should, regularly and systematically, be dragged after every rain, that high spots may be eliminated, low spots filled and the roads made as smooth and safe as possible with this temporary scheme to aid, as far as possible, transportation over public highways.

The Ring-Roll Mill

The ring-roll mill is made in two types, "Kent" and "Sturtevant." Both consist of a vertical ring and three rolls pressed against the inside surface of this by springs. In the former the rolls and ring-roll revolve, while in the latter the ring is stationary and the rolls not only revolve around their own axis, but also among the axis of the mill. The grinding is, of course, done between the rolls and ring.

These mills do not discharge a finished product but are used in connection with some form of screen, the tailings from the latter being returned to the mill. This type of mill will not give nearly so fine a product as the three preceding types even when a screen is used, but is satisfactory for 10-mesh material.

The Tube Mill

The tube mill is also employed to a limited extent for the preparation of agricultural ground limestone. It is not so well adapted for this purpose as the mills mentioned above, however, for the reason that it must be preceded by some form of coarse grinder, such as one of the foregoing mills or by a ball mill. The tube mill

is essentially a fine pulverizer and is therefore not so well adapted to producing economically material of only medium fineness. The large space required for the installation of the mill and the fact that it requires more power in grinding than the other types all limit its use.

Effect of Moisture

In the preparation of agricultural ground limestone, it is not usual to dry the rock before pulverizing nor is this necessary or desirable unless a very fine product is desired. The hammer mills are less affected by moisture than the screen mills. No difficulty will be experienced with coarsely grinding most limestone rock without drying with any of these mills, however, provided the rock is not actually wet and is free from clay. Even with wet rock if the fine material is first screened out and only the coarse ½ to 1-inch material is fed to the mill, very little difficulty will be experienced from clogged screens, etc.

(Continued in the August number.)

Road Material Producers on Favored List to Recieve Cars

UNDER THE RULING, recently announced, of the Car Service section of the railroad administration crushed stone, slag, sand and gravel and other highway materials directly follow coal, coke and ore on the preferential list to receive cars. The ruling will apply at all times except when the cars are more urgently needed for coal, coke and ore. The regulations are here given:

1. Open top cars, suitable for such traffic, should be furnished preferentially for the transportation of coal, coke and ore.

2. Available open top cars, not suitable for the transportation of coal, coke or ore, may be furnished for the transportation of stone, sand and gravel, and when so furnished shall be used preferentially for highway maintenance materials.

3. Open top cars, suitable for the transportation of coal, coke and ore, and available on coal, coke or ore producing roads in excess of the demand of such commodities, may be furnished for the transportation of stone, sand and gravel, and when so furnished shall be used preferentially for highway maintenance materials. The return movement to mines or ovens should be utilized wherever practicable in furnishing car supply for stone, sand and gravel. Every endeavor should be made, consistent with keeping up the production of coal, coke and ore, to furnish shippers of stone, sand and gravel with a minimum of forty per cent of their normal weekly transportation requirements.

4. Roads which are not producers of coal, coke or ore must not use foreign open top equipment for stone, sand or gravel shipments, except for one load in the course of the return movement to mines or ovens.

5. Where the transportation needs of essential road construction or maintenance projects cannot be met by car supply furnished in accordance with the above rules, the state, county or municipal officials in charge of the work, should, through their proper state highway department, apply to the Director of the Bureau of Public Roads, United States Department of Agriculture, Washington, D. C., for assistance. Such applications will be considered by representatives of the Department of Agriculture, the War Department, the War Industries Board, the fuel administration and the railroad administration, and in accordance with the recommendations of such representatives, the Car Service Section will endeavor to furnish car supply necessary for approved essential road construction or maintenance.

Miltary Highways

By Hon. LOGAN WALLER PAGE

Director, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture

(Reprinted by permission of the *Journal of the Franklin Institute*)

EDITOR'S NOTE: Lack of space prevents the reproduction in full of Mr. Page's article. We have endeavored, however, to select such portions of it as will make clear the Director's recommendations of a highway system adequate for wartime needs.

IN THE CONDUCT of modern warfare we now know that the highway plays no small part, because, in addition to its use as an avenue for marching troops, supply wagon trains, cavalry and artillery, it affords a means of rapid transport that is easily, quickly and economically constructed to carry heavy units of artillery and accessories, and the moving of large numbers of troops quickly.

The value of possessing a comprehensive system of military highways becomes at once very apparent when we hear that France was practically saved by her ever-ready system of roads and the great number of available motor busses, which quickly conveyed her troops to the point of attack. But in this connection we must not confuse the fact that the system as now completed at the French fighting front was not complete to start with; but it consists in considerable part of extensions to main arteries which were built years ago according to a program having the civil as well as the military roads as a basis of design.

Must Consider Civil Needs

This, in fact, is the only basis upon which any comprehensive system of highways can be designed, and any system not based upon the civil as well as the military problems involved is not only uneconomical but unstrategic, because the present war has thoroughly demonstrated that the organization of all civil as well as military elements is absolutely essential to the rapid production of large supplies and their speedy delivery. In this latter highways are great factors.

Our problem is not to develop a local network over small areas, but to provide, first, a series of main arteries between the large centers. If we should undertake to develop highways on the same scale that France has, there would be as many roads in New York and Pennsylvania as there were in Germany, and as many in New England as in Old England, Scotland and Wales. The development of such a system in detail would be unwarranted by our present economic requirements in times of peace.

Should Form Large Open Net

Further, the local construction of so close a network of roads would not be warranted over any one area to the exculsion of others. It appears plain, then, that the underlying principal of road location in a large way is to provide, first, the large open net of through roads over the entire area of boundary, choosing first those areas most open to attack.

Certain areas are obviously within this class, such as (a) the area about Long Island, comprising the New England states and New York; (b) the area about Cheaspeake Bay, comprising much of New Jersey, Pennsylvania, Maryland, Delaware, Virginia and North Carolina; (c) the Pacific Coast area of three states; (d) the Mexican border, comprising the southern part of Texas, New Mexico and Arizona; (e) the Great Lakes area, comprising parts of the Lake states; and (f) the Gulf area, comprising parts of the southern Gulf and Atlantic states.

Through Roads Necessary

In addition to a large network of roads, connecting the centers of population in these areas, there should be through roads leading inland to important centers of manufacturing and supply. The number of these necessarily depends upon economic conditions. Roads should connect the Pittsburgh, Cincinnati, Detroit, Chicago, Birmingham and other big industrial

(Continued on page 263.)

EDITORIAL

Pit and Quarry

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Co-operation and Fair Play

THE PRESIDENT of a quarry company writes as follows:

The writer has been in the stone business for more than twenty-five years, handling building, dimension and crushed stone. It has been a continuous fight all of this time to make even a meager percentage of profit, and I attribute this to the fact that quarrymen do not become acquainted with one another; do not visit and compare notes, etc., as they should.

Gravel and crushed stone men must play fair with one another. They must not be at one another's throats, for it is only they who will suffer.

This is only too true, and it is a plea for fair play and the healthy co-operation of those having common interests. Business conditions are abnormal now, especially in the stone, gravel and sand industries, but this feeling of fair play and co-operation is needed now more than ever.

It does not mean a restraint of business competition, nor of illegal combines to make the public pay more than a fair price, nor does it mean that the small operator must be throttled. It is such practices as these that have brought about so many laws affecting business until today we are suffering from "too much law."

The kind of co-operation of which this quarry owner writes is that of bringing about a better knowledge of producing and marketing quarry and pit products, that will help the general conditions and bring about a better feeling and understanding among operators.

Fair play, today more than ever, is a demand in the business world. We are engaged in a great war and struggle to establish fair play and democratic freedom among the nations of the world. If we are to win this war, as we must, we must practice fair play in our dealings with one another at home. In other words, we must practice what we preach.

It is true that unfair practices in the end reflect upon those who indulge in them. Quarrymen and pitmen in the past, and even today, in some sections of the country have resorted to cut-throat practices to their own detriment. All business should be upon the foundation of selling products at cost plus a fair profit. The public expects to pay such a price, but on the other hand the public is not willing to pay prices that mean excessive wastes in production.

First of all there must be co-operation in reducing costs. This means uniform cost-keeping systems, and

with some definite knowledge of costs it will be possible to eliminate those methods of production that mean only waste. It is hardly possible for every operator to have exactly the same cost-keeping forms. This is not necessary, but the fundamentals of cost-keeping for any industry are the same, thus it will be possible to make comparisons that will mean something. It is by cost-keeping that production is speeded and cheapened.

Results having been accomplished in this line, the next feature of the industry to consider is selling, which includes the giving of credit. It is in selling that the worst practices are employed. Then, too, many quarrymen and pitmen have trouble in extending credit. These things can only be bettered by active co-operation of all operators. There should be a credit department of the National Associations that would make reports on the financial standing of all purchasers of sand, stone and gravel. This association could also set standards of salesmanship as well as units of weights and measures.

PIT AND QUARRY offers the medium for operators to get together. It is publishing articles in every issue that are aimed to be of value not only in producing but also in selling. In addition, it welcomes letters and articles on these subjects from its readers, and comments upon the articles published. This journal will, we hope, be of assistance in giving standard cost systems and adopting the best methods and machinery for developing and operating quarries and pits. As the data can be collected it will go into the subject of deriving fair prices and will discuss the ethics of selling. The editors believe in fair play and co-operation.

Military Highways.

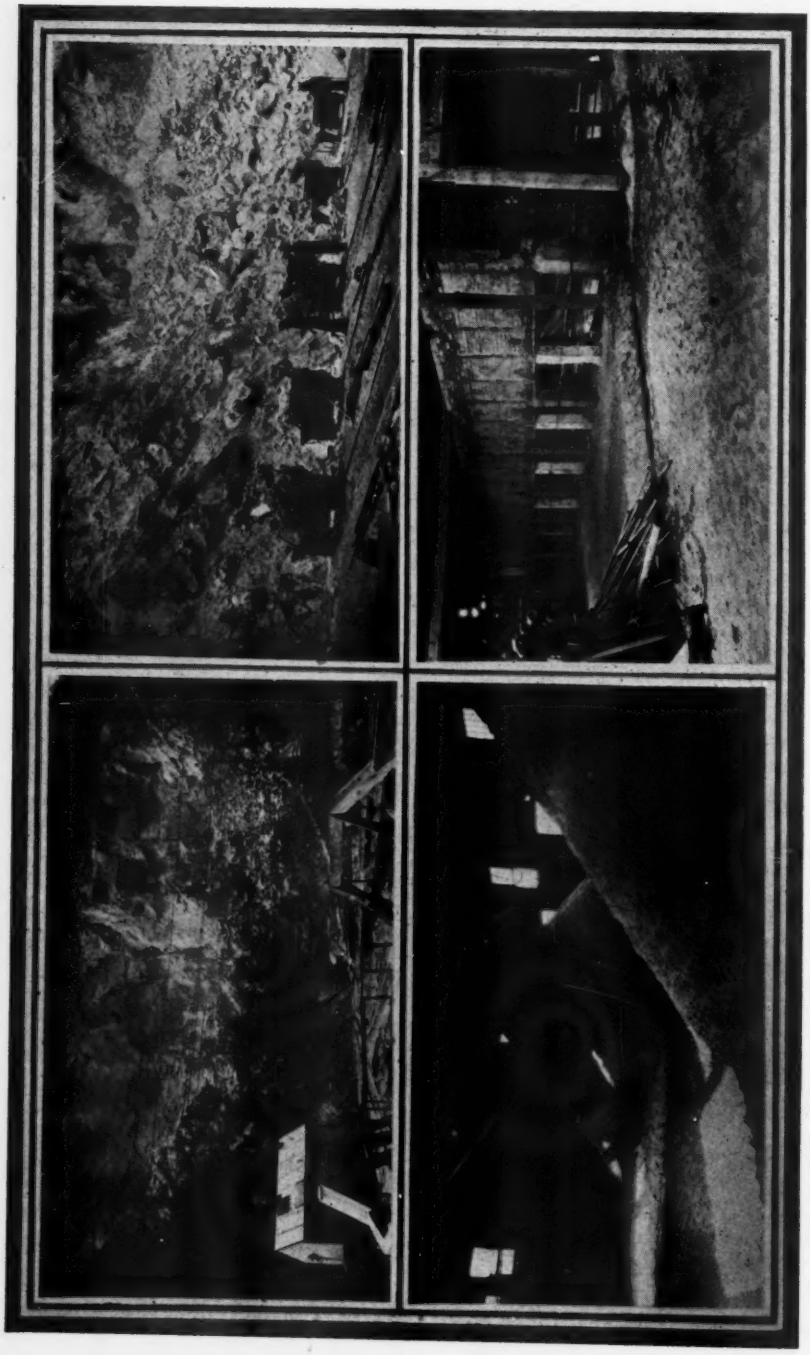
(Continued from page 261.)

districts with the coasts. The primary system must be designed in accordance with the demands of traffic and act as main arteries for the secondary system. The secondary system should be selected as feeders and connections to the primary system. It has been calculated quite accurately that twenty per cent of the highways in America carry eighty per cent of the traffic.

The design for highways improvements under ordinary conditions is not beyond a reasonable determination after a careful study of the traffic by means of traffic census and knowledge of the country to be served. The military road should be the most economical one, just as in the case of the selection under peace conditions. It appears, from the most reliable and first-hand sources of information, that water-bound macadam, telford, V-drains and stone base are the most effective purely military types of construction.

The traffic carried by the Bar-le-Duc-Verdun road was astounding in its wear and could not be halted. The question of restoration of road surface called for much ingenuity and was a matter of extreme expediency. Just what our American higher types of pavement would have suffered is hard to determine, as none of them is found to any great extent in the European zones of activity. Many of them would doubtless stand heavy pounding for a longer time than the macadam, but when rupture came the invariable requirement of immediate repair would force resort to materials and methods capable of rapid and effective application. It is seen at once that the exigencies of rapid construction, immediate serviceability and simplicity of methods and materials throw us back upon the lower rather than the higher types of road surfacing.

The general conclusion from these observations is that the planning and use of highways for military purposes introduces no new or essentially different principles and only a few altered assumptions. These assumptions are all in the direction of improved and heavier construction in most localities.



For explanation of pictures see following page.

West Virginia Glass Sand

Government Considers Suitability of Material for Optical Lens Manufacture—Berkeley Company's Operating Methods.

Explanation of Pictures on Opposite Page

Above—(At left.) Quarry of the Berkeley Glass Sand Co., showing the tunnel through the hard rock. (At right)—Loading glass sand in the quarry. Note the irregular shape of the blocks and the method of loading. Below—(At left)—Heaps of washed sand draining before going to the dryer. (At right)—Sand dryer, consisting of banks of steam pipes. Dry sand falls in thin streams onto a belt conveyor halfway between the brick wall and the ground.

A SHORTAGE of field glasses to equip officers in the army and navy has required the Government to undertake seriously the problem of making optical glass. A silica sand carrying less than 0.015 per cent of iron oxide is required. Deposits of pure quarts sandstone along the east side of Warm Spring Ridge, between Hancock, Md., and Berkeley Springs, W. Va., have long been quarried for glass sand. The industry has become one of considerable importance in the district, with an output in 1916 of 300,454 tons of glass sand, valued at $362,357, besides which sand was sold for building purposes, steel molding and engine sand. The output and value will be considerably higher in 1917, but figures are not yet available.

By R. W. STONE
United States Geological Survey

BERKELEY SPRINGS is in Morgan county, at the southern terminus of the Berkeley Springs branch of the Baltimore & Ohio railroad. All of the five quarries there are on the hillside above the railroad and within one-half mile of it.

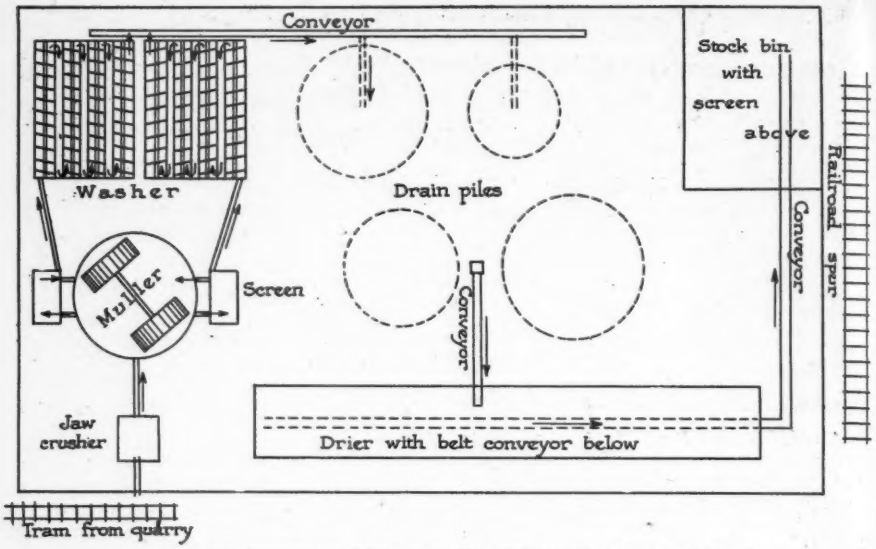
Glass sand is derived from Oriskany sandstone, which outcrops along the east side of Warm Spring Ridge as part of a monoclinal series of beds between a syncline of carboniferous rocks forming Sleepy Creek Mountain on the east and an anticline exposing Medina sandstone in Cacapon Mountain on the west.

In the vicinity of Berkeley Springs the Oriskany sandstone is 150 to 200 feet thick. The upper 20 feet is hard and is not quarried, being left as a wall which, as quarrying progresses, serves more and more to protect the highway from blasting in the pits behind it.

This pure white quartz sand is a beach or near-shore deposit, and its purity, freedom from mud and other fine detritus, the uniform size of its particles and their sub-rounded character indicate long-continued sorting action at this part of the shore. The size of the grains is well adapted to glass sand, practically all passing a screen having 40 meshes to the inch and 25 per cent passing 60-mesh screen.

At the surface the rock is indurated or harder than a few feet below the surface, and it is slightly glazed. This is probably due to solution and redeposition of silica between the grains. Below the surface the grains are loosely cemented by lime, and the rock is commonly so soft that it readily crushes to individual grains.

Blocks blasted from the ledge are broken down with no difficulty by the use of sledge hammers to lumps that one man can handle. Because of the softness, although it occurs in beds,



PLAN OF BERKELEY MILL FOR WASHING AND DRYING SAND

the rock breaks in irregular blocks rather than in squares or slabs. Much of the rock broken by a big blast is so fine that it is loaded in tram cars with a shovel instead of the customary fork.

Near the surface the larger joint planes in the sandstone are discolored with soil and vegetable stain. This can be removed by washing and does not disqualify the rock for use as glass sand.

In 1917 five companies were operating eight quarries and seven mills. The method of operating is practically the same in all. Rock is drilled by compressed air or steam drills, broken from the ledge in large masses with explosives, loaded by hand into small tram cars, which are gathered by horse, mule or man power, and sent to the mill, in most cases by gravity. Empty cars are returned to the quarry by steel cable haulage or by a dinky locomotive.

GRADING, CRUSHING, GRINDING, WASHING AND DRAINING

Separation of rock for first and second grade sand is made by hand in the quarries. At the mill the rock is reduced by a jaw crusher to lumps the size of a man's hand and falls from the crusher into a pug mill or muller, where it is crushed to individual grains.

This mill is a metal pan or vat several feet wide and deep, in which two large steel-rimmed stone wheels revolve on a horizontal axis pivoted at the center of the pan. Grinding is done in water and the fine material is washed through the perforated side of the pan into a revolving screen. A stream of water playing on this screen washes the fine sand through it. The oversize returns to the muller for regrinding.

Sand which has passed the wet screen flows to the washers. These are long, narrow, inclined boxes of heavy lumber in which large iron screws revolve. As it is carried up the trough by the screw the sand is tumbled over and over in water. At the upper end of the trough a jet of water washes the sand into a parallel and smaller box of the same length, down which it

flows and is cleaned by knocking against riffles.

Successive passing of the sand through a set of three or four washers thoroughly eliminates all very fine and foreign material. The clean white silica grains fall from the last washer onto a belt conveyor, by which they are elevated and spilled in a heap on the draining floor.

Drying and Storage.

The drained sand is raised by portable bucket-belt conveyor or by a Telfer bucket and dumped direct or by moving belt onto the drier. A sand drier consists of steam pipes in banks of 15 to 20 arranged in tiers one above another. The pipes in the lower tier are smaller and closer together than those above. The banks of pipes are 50 to 100 or more feet long, depending on the capacity required, and are enclosed on both sides with a brick wall.

The drier has a hopper bottom, which directs the dry sand through a slit onto a belt conveyor. From the discharge end of the belt the sand is elevated to concrete or metal storage bins built high enough for their contents to be discharged by gravity into railroad cars.

At some plants the dry sand is screened before storing. The clean white sand is usually shipped in bulk in box cars lined with paper to prevent leakage, and is used for making plate, window, table, prescription and other kinds of glass.

Berkeley Company's Plant.

The quarry and mill of the Berkeley Glass Sand Co. are on the northern edge of the town of Berkeley Springs and about one-half mile from the railway station. The quarry, like all the others, is on the upperside of the road. It is midway of the ridge slope, and the quarry floor is about 150 feet above the valley bottom.

The hard cap rock of the Oriskany formation is not quarried, and the sand pit is entered by a short tunnel through it. The quarry face is about 300 feet high, but the floor is only about 60x150 feet. Drilling is by compressed air. Eight tracks lead to the working face, where small mine cars are loaded by hand. Loaded cars are drawn to the mill by horses.

At the mill there are three dumping chutes, one each for hard rock, grade 1 and grade 2. Hard rock is crushed in a separate mill and loaded direct on cars by traveling belt without intervening storage. This hard sandstone is shipped to Baltimore for making ferro-silicon. Grade 1 and grade 2 sands are separated at the quarry and are milled in separate units. A unit consists of one muller, two screens and eight screw washers.

The company has furnished the government with sand practically free of iron, analyses of which, as made by H. S. Washington and J. B. Ferguson, show 0.025 and 0.016 $Fe_2^0_3$.

The crushers, mull pans, washers and dryers were furnished by the Lewistown Foundry & Machiney Company, Lewistown, Pa. The boiler was purchased from the E. Keeler Company, Williamsport, Pa. The air compressor and drills were purchased from the Ingersoll Rand Company, and the traveling crane from the Northern Engineering Works, Detroit, Mich.

A total of $2,601,000 worth of Liberty Bonds has been taken by the employes of the Westinghouse Electric and Manufacturing Co. The company employs over 30,000 people, and in order to cover the entire works thoroughly from office boy to executive, team captains were appointed, who, in turn, were lieutenants of teams. The members of these teams sold each employe a bond or got a very satisfactory reason for their refusal.

Working Sand and Gravel Pits

IN FORMER ARTICLES the general features of working pits have been discussed. In the May issue the various methods of excavating pits from on top were described. In this article the methods of working pits against a breast are pointed out and comments made as to their economy.

BY D. J. HAUER, C. E.

WHEN WORKING PITS from on top the same machinery used for excavating the product can be used for the stripping, but this is not true in case of working against a breast. If the bank is a high one and the overburden a small percentage of the entire mass, say less than five per cent, then it may be possible to carry on the entire excavation as one operation. With stripping necessary there must be two operations.

If these two operations must go on simultaneously, then there must be two sets of machines used at the bank, making a large capital expenditure. It is for this reason that a large number of banks are worked by hand methods. Even if the sand or gravel is excavated by some type of machine, the stripping may be done by hand.

If the product does not have to be either washed or screened, and the operation is small, then hand methods may be advisable, but in most cases it is not economical for either the stripping or the excavation of the product. A small steam shovel operating against a breast has proven economical, when common labor could be hired for less than twenty cents an hour, and less than a hundred cubic yards were excavated in a day. With wages at thirty to forty cents per hour, excavation can be done economically by machines when the yardage is fifty or less. Such facts as these should be known by owners doing hand work.

IF AN OWNER has a regular output and sale for even a limited quantity of sand and gravel, he can, in most cases, afford to go into debt to secure some type of excavator, for the machine will save enough in labor to pay for itself in a reasonable time. If the business increases, the same machinery will more than likely be able to produce four or five times the quantity with but small additional cost. These facts have been proven in clay pits as well as in sand and gravel banks. Machinery cannot be recommended for small production and only occasional outputs.

It is due to the fact that stripping is frequently limited to a short time in a season, or is very light, that it seldom pays to install the same machinery for this operation as for the excavation of the product. For such stripping scrapers can be recommended, and the remarks made regarding the four kinds of scrapers for pit work in the May, 1918, issue of PIT AND QUARRY are applicable for this operation.

If the stripping is heavy and can be done against a high breast, then the machines to be described for excavating the product can also be used for the stripping, either by duplicating the plant, or by working it for stripping in the off season.

WORKING AGAINST A BREAST

Almost every type and size of steam, electric or gasoline shovel can be used in pits against a breast, but there is one that should be given special mention. This is the Keystone excavator. The body of this machine is modeled after that of a well driller, but it is fit-

ted with a set of spreaders or jack arms to steady and hold it to its work while excavating. A light steel boom in front holds and operates the dipper.

Of the latter there are three shapes. One is known as the skimmer dipper, which is shaped somewhat like a square-cornered drag scraper. In operation the boom is dropped close to the ground, and the dipper skims along the surface taking a cut from the ground. This skimming motion gives the dipper its name. The dipper once loaded, the boom is raised and swung around, dumping the load into a vehicle of some kind. It is by means of this dipper that either light or heavy skimming can be done, so that the machine is well adapted to stripping banks or working out thin or shallow veins of sand or gravel. It even becomes possible to clear off and take out a thin vein of valuable clay, when otherwise when excavated by different machines, the clay could not be saved, but would only prove a source of expense, as it would become mixed up with the product.

The second shaped dipper is called the draw ditcher scoop. Primarily designed for excavating either ditches or trenches, this dipper has proved economical in excavating pits, cellars, etc. It has a hinged motion at the end of the boom and is shaped like a regular steam shovel dipper, but instead of digging away from the body of the shovel and above the grade of the wheels, it digs towards the machine and below the grade of the wheels. This machine could be classed with those working a pit from on top, but inasmuch as the dipper must work against a breast or bank it is proper to discuss its work in this article.

The value of this dipper in stripping operations is that pockets of clay or loam can be excavated cheaply after the main stripping is done. For pit excavation this scoop will allow sand or gravel to be excavated below water level without operating pumps, keeping the machine above the water line.

The third dipper is like the ordinary steam shovel kind, operating in the same manner, so that either for stripping or pit excavation against a breast this excavator can be used. The fact that it is light, of easy traction up and down steep grades and can travel a mile and a half per hour allows the excavator being moved either quickly or cheaply from one part of a pit to another and from the operation of stripping to that of production.

Items Governing Choice of Machine

For excavating pits against a breast the power shovel is, without doubt, the ideal machine. Such shovels are built with dippers of a half a cubic yard capacity to about ten cubic yards, so that the variation gives a wide selection. The size and type of machine to be installed must depend upon local conditions, character of the material, height of the bank, amount to be excavated each day, mode of transportation and whether or not the product must be screened or washed, as well as other features of the work. A large shovel will be needed for loading gravel directly into railroad cars when three or four thousand tons daily must be produced. The large dipper will mean quick loading and the labor item will be kept at the minimum. Irregular loading of a few wagons or some small cars in a day calls for a small shovel.

If the bank has only a reasonable height and trucks are to be loaded on top of the bank to prevent them from being stuck in the pit or to save building expensive roads in the pit, a shovel of fair capacity will be needed, either with a boom of high reach or a special boom built for the work.

There are now on the market some shovels that permit the dipper being taken from the boom and a grab bucket operated on it. For some pits such a shovel possesses special value. If part of the sand or gravel is above the water bearing line, the shovel can be used with its regular dipper to excavate the dry material, while a grab bucket can be used to excavate in the water bearing stratum, thus saving pumping.

Transporting Material to the Plant

In using power shovels some means of transporting the material must be employed if the product is to be screened, washed or stored. If not the shovel loads directly into the delivery vehicle or car. If the material is screened or washed, then the product must be hauled to the screening or washing plant for this purpose, carts, wagons, trucks, and conveyors are used.

One-horse carts are never economical, for with a two-horse vehicle more

than twice the same amount can be transported, while the cost is only slightly increased. Two-horse dump wagons are more economical than the carts, and for short hauls are better than trucks. For long hauls the trucks are efficient.

Small cars pulled by a gasoline engine can handle a large daily output at a small cost. Two trains can keep both the power shovel and the screening and washing plant busy. The size and type of cars to be used must be governed by the grades of the rail and the amount of material to be handled.

Use of Belt Conveyors

Belt conveyors have not been used extensively, except for short distances, for transporting material from an excavator to a plant, but that is no reason why they should not be employed more extensively, especially when the ordinary methods of transportation are so costly. For conveyors the capital expenditure is generally large, but the operating costs are rather low, the belts being a maintenance cost that can be kept reasonable if proper attention is given. The use of conveyors can be recommended when the pits are deep so that a shovel is kept working in a limited area for some days or weeks, thus changing the conveyor line but seldom.

Portable Machines

For limited outputs from pits that must be worked with small capital, there are several methods of working against a bank without using a steam shovel, and with only a reasonable cost for plant and operation. One such machine is the portable bucket conveyor for loading wagons and trucks. This can be used in banks by working the lower end into the bank so that the buckets will pick up the sand or gravel. To make it do this it is necessary to cave in the bank so that the conveyor will keep picking up the material. Two men do this and they also, with shovels, keep the bottom cleaned up, just as is done in picking up a stock pile. These men also look after the operating and moving the wagon loader. The work done is far cheaper and quicker than by hand. There are a number of such machines for sale.

Double Scraper Arrangement

Another excavating apparatus for working against a breast is a double scraper arrangement. Dead men are set in the top of the bank and lines are run from a hoisting engine to the dead men in the drag lines to the scrapers. The lines are so arranged as to pull a load while an empty is going back, thus sand or gravel can be excavated and transported to a car, bins, screens or washer. The hoisting engine is placed at the foot of the bank. This apparatus has been previously described in Pit and Quarry.

Another simple machine that can be used to excavate a bank is the Albrecht excavator. The machine is set on top of the bank while the deadman is placed in the pit. The single scraper is pulled up the face of the bank and dumps over the hoist into a wagon or truck.

These are the principal methods and machines that are adapted to working banks to suit nearly all conditions that are usually found. Much that has been written in this series of articles about pits for sand and gravel is applicable to clay and ore pits.

Ware Plant Sold.

THE ENTIRE PLANT and good will of the Ware Sand & Gravel Company, Cincinnati, Ohio, has been purchased by the Ohio River Sand & Gravel Company, recently formed in Cincinnati. The plant has been completely overhauled and is now ready for business. Considerable damage was done to it by the ice in the Ohio river last winter. It is understood that the suction dredge boat, several barges and unloading equipment were sunk. This plant was described in the June issue.

Bookkeeping Articles.

THE SECOND of the series of articles on "Bookkeeping," by Edwin L. Seabrook, begun in the June issue, will not appear until the August number.

WE ARE also very much interested in the advertising matter in Pit and Quarry, which we will undoubtedly be able to use to advantage from time to time.—Carpenter & Knight, Morristown, N. J.

DEVOTED as it is to sand, gravel and crushed stone exclusively, Pit and Quarry fills an important field.—Geneva Limestone Co., Geneva, N. Y.

ASSOCIATION ACTIVITIES

Makes Important Changes

Agricultural Material Association Plans Extensive Campaign to Increase Use of Product—Organization Changes Name.

THREE SIGNIFICANT MOVES for developing the agricultural stone business throughout the country were planned at the meeting of the Agricultural Lime and Limestone Association, held at Hotel Hollenden, Cleveland, Ohio, June 6. These will include a cooperative advertising campaign, dealing with the shipping question, and appointment of committees to carry out the work of both.

The transportation problem was brought a bit closer to home by the fact that the Youngstown delegation was considerably late in arriving, thus delaying the meeting. While awaiting them an informal discussion was held among the members, in which it developed there is a fast growing field for the product of the organization, because of the increasing favor with which farmers are looking upon the use of limestone for enriching their lands.

At this meeting F. R. Kanengeiser, vice president and general manager of the Bessemer Limestone Company, Youngstown, presided. G. J. Wilder, manager of the organization, told of the results he has obtained in a survey of the pulverized limestone process. He told the members he had received much encouragement towards increasing the membership from firms all over the country. An especially interesting piece of information received through this survey, Mr. Wilder pointed out, was that a member on the Pacific Coast now is preparing to put the product into the citrus fruit lands in the vicinity of Fresno, California.

It was Mr. Wilder's opinion that the Cleveland meeting would be reflected to the advantage of the trade all over the country. He urged united effort in the educational campaign to reach farmers through the cooperative advertising method. He said that it had been found that united advertising will get more space for the money in the various farm journals.

Association Changes Name

From now on the organization will be known as the National Agricultural Pulverized Limestone Association. The move to change the name is the outcome of an action at the previous meeting. The change, according to J. C. King, of the Carbon Limestone Company, Youngstown, and secretary of the organization, was considered best because it was deemed not a good policy to use several different brands of lime. This move has culminated in the decision to have 60 per cent of the product to pass through a 100 mesh and all through a 10 mesh screen. On account of some firms not being equipped with the 100 mesh, the 60 per cent limit was adopted, until all can produce a finer material.

To meet the idea of one brand the first letters of each word in the new name of the organization, N, A, P, L, A, have been combined to make the name of the brand, and this word "NAPLA" will be copyrighted.

Annual Meeting in October

Following adoption of the new name, several changes were made in the constitution of the organization, making for permanence in the association. These include the selection of October as the month for the annual meeting; adopting plans for the promotion of the trade name so as to make it as well known as "Mazda" or

"Uneeda Biscuit"; and that membership in the association shall include any corporation interested in or engaged in the production of lime for agricultural purposes. All members or producers selling a lime product bearing the recommendation of the name NAPLA shall have the backing and support of the association. A provision has been made in the constitution that such product must pass the specification of 60 per cent through 100 mesh and 100 per cent through 10 mesh screens.

Significance is attached to the quantity of material with which the organization can start to do business. It is estimated there are 250,000 tons of limestone available now. According to Mr. King, the Youngstown district alone will produce 150,000 tons this year.

From now on semi-annual meetings will be held on the first Tuesday of July and the first Tuesday of October.

Several companies have been added to the membership at this meeting, some of which were unable to send delegates. Among them are: The France Stone Company, Bessemer Limestone Company, Kelly Island Lime and Transport Company, Ohio Marble Company, O. C. Barber, Marble Cliff Quarries Company, A. & C. Lime Company, Federal Lime and Stone Company, Carbon Limestone Company, and the Michigan Limestone Company.

Election of Officers

Following permanent organization, officers were elected. They are:

President—J. C. King, Carbon Limestone Company, Youngstown, Ohio.

Vice president—W. H. Hoagland, Marble Cliff Quarries Company, Columbus, Ohio.

Mr. Wilder was retained as manager. The Executive committee includes F. R. Kanengeiser, Bessemer Limestone Co., Youngstown, Ohio, chairman; H. E. Bair, France Stone Co., Toledo, Ohio; Henry Angel, Kelley Island Lime & Transport Co., Cleveland, Ohio; J. W. Wirth, Agricultural & Commercial Lime Co., Canton, Ohio, and A. Acton Hall, Ohio Marble Co., Piqua, Ohio.

The first step of the Executive committee will be to have the trade name copyrighted and the association incorporated.

Among those who attended the meeting were: W. M. Brown, France Stone Company, Toledo; F. R. Kanengeiser; C. C. Hall, G. W. Johnston Limestone Company, New Castle, Pa.; G. J. Wilder, manager, Columbus, Ohio; W. P. Kelly, Dolomite Products Company, Cleveland, Ohio; Henry Angel; J. C. King; J. W. Wirth; C. W. Hitchcock, Federal Lime and Stone Company, Cleveland, Ohio; R. H. Minimum and P. C. Hodges, Marble Cliff Quarries Company, Columbus; C. J. Reilly and A. T. McCormack, Sandusky Cement Company, Sandusky, Ohio; C. C. Calvin, Bessemer Limestone Company, Youngstown, Ohio, and Samuel G. Wells, George and Sherrard Paper Company, Wellsburg, W. Va.

To Illinois Quarrymen

ILLINOIS QUARRYMEN, convinced of the fact that to properly cooperate with the government, which wishes to deal with industries as a whole rather than individuals when forming war policies, met at the La Salle Hotel in Chicago, June 26, and took the first step towards what will soon prove to be a strong state association. Such an organization has been greatly needed for some time and the industry in Illinois has suffered by the lack of it.

The utterances of those present at the meeting, and statements made in person and by letter to R. W. Scherer, secretary of the energetic Wisconsin association, who has visited nearly all of the Illinois men to lay before them the necessity of joining their own state organization, are indeed promising. There are bright prospects of the coming of the time when every quarryman in the state will meet, probably in Springfield, break bread and find out what they really already know—that competitors and fellow quarrymen are good, honorable fellows, and that they should have gotten together long ago.

Such a meeting would be a blessing to the industry as a whole and to each man individually. It is by NOT coming in co-operative contact with one

E. J. KRAUSE
President, Illinois Crushed Stone Association

another that unworthy suspicions are born and grow as time goes on. This was the condition of the quarry industry in Ohio, Indiana, Wisconsin and eastern Pennyslvania until by organization the members reaped extensive financial and moral benefits. Their organizations are respected, are consulted about legislative and other measures affecting its members, are strong enough to protect themselves from encroachments upon their rights, and are able to put through just, constructive measures for general improvement. Nearly every big industry is organized and the stone men must become so. Co-operation is no longer ridiculed by men of vision. Every state in the Union should organize, and together join the National association to represent them in problems of national importance. Of these, there are aplenty these days.

Illinois has good reason to look forward to a vigorous, influential state association, for her quarrymen are individually progressive. Several of them have contributed much in time and money for the good of all. Now that the movement is so well started every man should add to its momentum by resolving to make whatever sacrifices are necessary to get their association firmly launched.

New Officers

The new officers are of this type and deserve the unqualified support of every member. They are as follows:

President—E. J. Krause, Columbia Quarry Co., St. Louis, Mo.

Vice-President—J. J. Sullivan, Dolese & Shepard Co., Chicago, Ill.

Treasurer—A. J. Sullivan, United States Crushed Stone Co., Chicago, Ill.

A secretary will be selected later who will give all of his time to the association, under salary, and be located at Springfield.

The board of directors also chosen consists of J. A. Donovan, chairman, Superior Stone Co., Chicago; J. J. O'Laughlin, A. C. O'Laughlin Co., Chicago; Daniel Foley, Brownell Improvement Co., Chicago; F. W. Stolle, Casper-Stolle Quarry & Construction Co., E. St. Louis; and W. S. Charles, Charles Stone Co., Marion.

A meeting of this board will be called in the near future.

Under the membership contract each firm is to pay one-third of a cent per ton on sales of all stone except fluxing stone and ballast, starting with the 1917 production. Payments are to be made in such amounts as may be called for from time to time by the board of directors. Membership insures eligibility for membership in the National Crushed Stone Association and participation in the publicity program that will be carried out in conjunction with the Wisconsin association under the supervision of Secretary Scherer.

A. P. Sandles, secretary of National

MEN AND MACHINERY

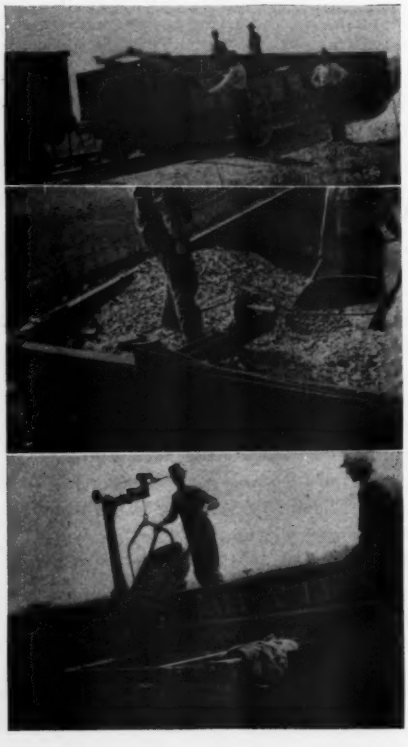
New Unloading Device

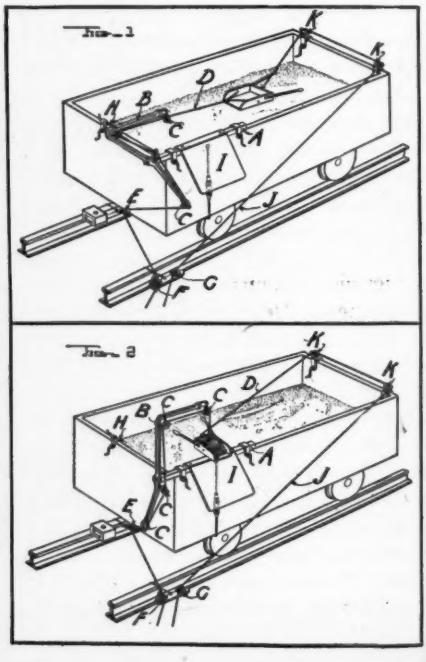
A TIMELY INVENTION is the Yearwood device for unloading railway cars and barges. The pictures show it in detail and in operation. Its inventor is J. R. Yearwood, of the Bluffton-Lewisburg Stone Co., Lima, Ohio. Mr. Yearwood, with T. G. Harris as secretary, is manufacturing the unloader under the firm name of Yearwood-Harris Unloader Co., Lima, Ohio. Another type of machine, to be operated by gasoline power, is under way and will be placed on the market soon.

The unloader is simple, inexpensive and said to be highly efficient. A horizontal supporting bar (A) is clamped on the upper edge of a car body or barge, the outer end extending beyond the body and supporting a vertical swinging lever (B) fulcrumed between its ends. One end is directed laterally to overlie the body of the car or barge, and the other end inclines downward. Each end and the two angles between them carries a sheave (C) to carry the cable (D) attached to the bucket-scoop.

The other end of the cable passes around a pulley (E) anchored to a rail and another pulley (F) secured to the opposite rail and continues to any pulling means such as a windlass or a snatch team. In the case of a barge it is necessary to attach the pulleys to other appropriate parts. The pulley G is also mounted on the same block with pulley F. Its duty will be explained later.

As shown in Fig. 1 lever B is in horizontal plane, with its lateral-directed end resting upon the upper edge of the car body and held in position by the bolt H, also clamped to the car. When the cable has been pulled to the re-





NEW PLANT OF THE DUPLEX TRUCK CO., LANSING, MICH.

quired extent to load the scoop and draw it to the end of the lever a trip-button on the cable releases the automatic latch so that a further pull upon the cable will move the lower end of the lever to a vertical position and thus raise the loaded scoop above the edge of the car so that it may be pumped upon a chute (I) which passes the material into wagons or motor trucks.

A second cable (J), one end of which is attached to the scoop and the other end passing around the pulley G, returns the scoop to any desired point in the car or barge. This cable leads to a windlass, the intermediate portion being trained around a pair of guide pulleys (K-K) clamped to the top edge of the car.

The unloader permits of minor changes without sacrificing the principal advantages.

New Duplex Plant.

THE DUPLEX Truck Co., Lansing, Mich., has occupied its fine new factory buildings, just completed. With practically no waste of time the new factory took up the work where the old left off. About 100,000 square feet of additional floor space are thus added, one of the buildings being 402 by 72 feet, and the other 306 by 72 feet. Both are two-story structures.

The company will be able to increase its output in 1918 to about ten times the 1917 production. Duplex trucks to be manufactured during the year just begun will approximate a total value of $13,000,000. Every month three hundred trucks will be turned out.

In appearance, lighting and efficient arrangement the new factory leaves nothing to be desired. The construction is the most modern type of reinforced concrete and steel, faced with brick. Floor arrangements throughout are ideal. The assembly floor is a marvel of efficient arrangement. Every possible precaution was taken in its planning to eliminate lost motion and unnecessary effort.

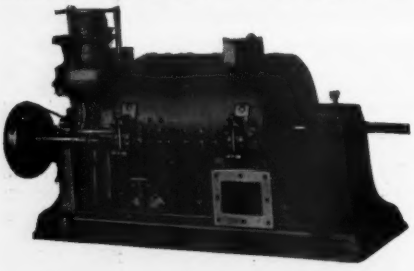
The moving of all materials and machinery from the old Charlotte plant to Lansing was accomplished with Duplex trucks, showing a saving of more than $500. This does not take into account the fact that it would have been necessary to handle the bulky machinery and materials four times, instead of twice had the goods been shipped by rail. In all, 224 trips were made, through eight inches of snow, with an average load of three and one-half tons on the truck. In some cases much larger loads were hauled.

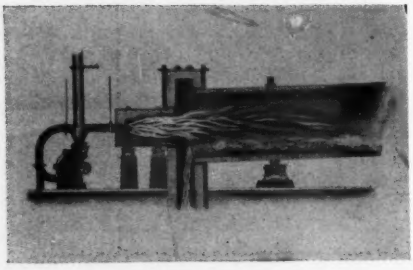
The illuminating engineers of the Edison Lamp Works of the General Electric Company have prepared Bul-

letin No. 43410 containing the latest information as to the correct methods of lighting industrial plants. The Bulletin is well illustrated, showing various lighting schemes most suitable for industrial purposes and the facts are brought out that to conserve the employes' health, save coal, increase the output and to keep the workers contented, it is necessary that a plant or shop be well illuminated according to modern methods.

Coal Pulverizer.

PULVERIZED FUEL combustion is a subject of widening interest. Pulverized coal makes for high efficiency. The Aero machine, pictured here, causes coal to burn like a gas, produc-





ing at will a wide range of temperatures. Each pulverizer operates with a single furnace as a unit and crushes the coal as used. No storage of pulverized coal is required. It handles both wet and dry coal and makes possible the use of low grade or slack coals if they contain 25 per cent or more of volatile combustible.

Each pulverizer runs at constant speed and may be fed by hand or by mechanical devices. The operator's attention is limited to observation of his fire and the regulation of the feed mechanism and air dampers. One operator can attend to a number of pulverizers. It is strongly built, dust proof and arranged for easy repair to the parts susceptible to wear. The discharge is either right or left hand, according to specification. Five sizes are made, handling from 600 to 5,000 pounds of soft coal per hour. The Aero Pulverizer Co., 120 Broadway, New York, N. Y., is the manufacturer. Complete information is given in Bulletin 26.

"Flexible Arm" Shaker Screens.

THE USERS of the G-R-M "flexible arm" shaker screens attribute their satisfaction to perfect cleanliness of the products and the excellence of the grading; these screens also give a very large capacity for the amount of space required. The material is passed through the large perforations first; only the sand and fine gravel ever reach the "deck" with the smallest perforations.

The screens are built with as many "decks" as necessary to give the desired grading of the material. The screening surface consists of heavy steel plate with perforations made to suit the user. These perforated plates can be easily removed and others substituted, when a different system of grading is desired.

A new and clever design of wash water sprays is another feature. The sprays are sharp and cut the dirt off the gravel quickly. The water streams down evenly through all the decks and thoroughly washes all the sizes—"clean as marbles," one man says of the graded materials produced.

Another trouble now overcome was the serious wear on pins and links at the various supports, as well as on the drive. The flexible arm design has eliminated these troublesome features entirely. The G-R-M shaker screens are built very strong to resist the severe service of the gravel washing plant. The Good Roads Machinery Co., Inc., Ft. Wayne, Ind., is the manufacturer.

THE SAN FRANCISCO office of the Blaw-Knox Company has been removed from the Rialto building to the company's new office and warehouse at 528-530 Second street. O. B. Pulis is in charge.

CALDWELL

Machinery for Handling

Stone—Sand—Gravel

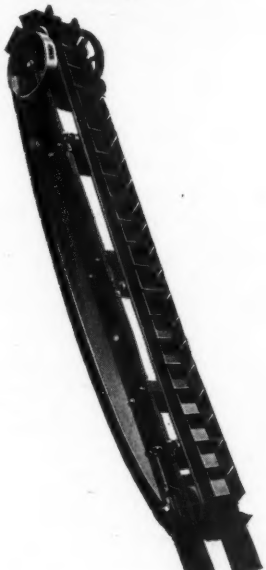
SCREW AND BELT CONVEYORS.

STEEL ELEVATOR CASINGS AND BUCKETS.

GEARS—with cut or cast teeth.

LINK CHAIN BELTING

SHAFTING—Chilled Rim Sprockets.



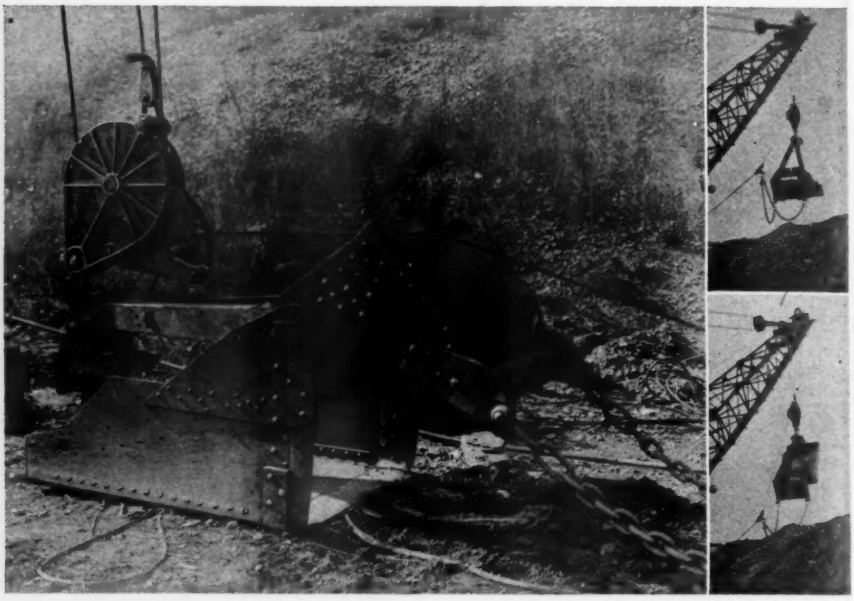
Upon receipt of specifications, blue prints or sketch, we will be glad to have our engineering department assist you with your Elevating, Conveying and Power Transmitting Machinery Problems.

Catalog No. 38

H. W. CALDWELL & SON CO.

CHICAGO

Western Ave., 17th and 18th Sts.



New Type Bucket Has Many Advantages.

H. T. DUNBAR, president of the Dunbar Stone Co., Detroit, Mich., and the Dunbar & Sullivan Dredging Company of Buffalo, N. Y., has designed a new type of excavating bucket. The large picture shows a near view of the bucket and the others show the bucket as loaded and as dumped. The bucket may be termed a drag-clam. The drag line is attached to the chains leading from the door. The door swings on a large shaft. From the door two arms lead off to the hoisting sheave. When the bucket is dumped it swings on the shaft until the dogs on each side of the arms catch and hold the door open. When dropped into the pit and loaded the dogs release themselves, and by hoisting the door closes.

These buckets were used by the dredging concern on its Barge Canal contracts at Waterford, N. Y., and gave complete satisfaction. They loaded in the length of themselves, did not have to be dragged to the bank, and when the door closed the load was held, always loading to capacity and did not bail water. The company states that the buckets gave a decided saving in cables and less coal was needed in their operation. They are of three cubic yards capacity. The near view of the bucket shows the hoisting, dragging and dumping rigging.

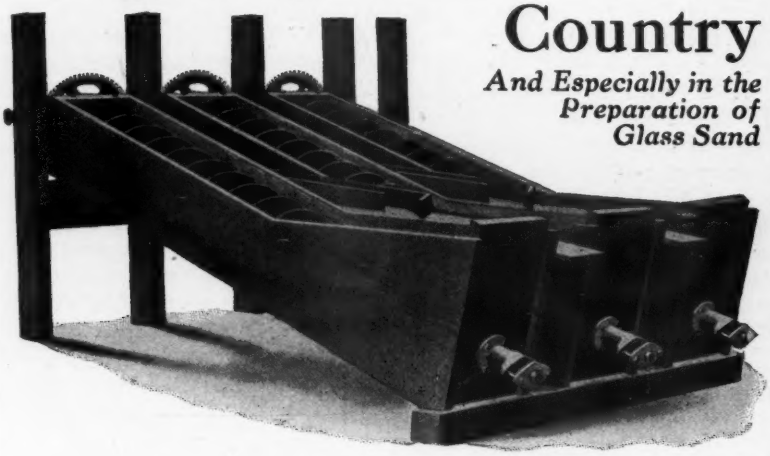
H. D. WRIGHT, manager of the San Francisco office, Brown Hoisting Machinery Co., has been appointed representative of the company for the Northwest territory, succeeding the Colby Engineering Company.

THE ORENSTEIN-ARTHUR KOPPEL CO., manufacturer of dredging and grading machinery and light railway equipment, is building a new plant at Koppel, a new industrial center which is developing just north of Pittsburgh. The Koppel Land Co., a subsidiary of the manufacturing company, is handling the land and housing developments of the new town.

Grace Motors, Limited, with headquarters in Toronto, and branches in the principal cities of the Dominion, is now the Canadian distributer for the Sterling Motor Truck Company, of Milwaukee, Wis.

Used in Some of the Largest Quarries in the Country

And Especially in the Preparation of Glass Sand



LEWISTOWN
Sand Washers

These are reasonably priced, well built, compact outfits, which can be easily and quickly installed. They are simple in construction and efficient in operation. Extensively used in the manufacture of glass sand which is so much needed today in the making of optical lenses for field glasses, telescopes, etc., required by the Government.

If you are not acquainted with Lewistown equipment and service, it will pay you to look into it.

We are in position to assist you solve your problem of whatever nature, if it pertains to crushing, grinding, screening, washing, drying and conveying, as we manufacture a full line of this machinery and equipment. Drop us a line stating what you desire information on.

Lewistown Fdy. & Machine Co.

LEWISTOWN, PENN.

association, was present and explained conditions affecting the industry as they exist in Washington. He is in constant touch with department heads there and will represent the crushed stone industry at a meeting July 10 in the office of L. W. Page, Director of Public Roads, for the purpose of discussing the recent freight rate increase.

R. W. Scherer, secretary of the Wisconsin association, also took an active part in the meeting, particularly in the discussion of the publicity work to be started soon.

The following firms were represented personally or by proxy and will be members:

Casper-Stolle Quarry & Construction Co., E. St. Louis.
Charles Stone Co., Marion.
Superior Stone Co., Chicago.
Illinois & Argo Stone Co., Chicago.
Dolese & Shepard Co., Chicago.
United States Crushed Stone Co., Chicago.
Columbia Quarry Co., St. Louis, Mo.
Artesian Stone & Lime Works, Chicago.
Universal Crushed Stone Co., Chicago.
Belvidere Stone Co., Belvidere.
Elmhurst-Chicago Stone Co., Elmhurst.
A. C. O'Laughlin Co., Chicago.

Concrete Institute.

THE AMERICAN Concrete Institute was in session June 27-29 at the Hotel Traymore, Atlantic City, N. J. An added feature this year was several papers on the subject of concrete ships. A moving picture of the launching at San Francisco of the 4,500-ton ship "Faith" was shown.

Cement Association Meets.

FIFTY-FOUR members of the Portland Cement Association met at the Blackstone hotel, Chicago, Ill., May 20-22, the occasion being the usual spring conference. Two new members were reported — the Wellston Iron Furnace Co., Jackson, Ohio, which recently purchased the plant of the Superior Cement Co. at Ironton, Ohio, and the Cuban Portland Cement Co., of New York.

Ohio S. and G. Meeting July 10.

AMONG OTHER interesting things taken care of at a meeting of the Ohio Sand and Gravel Producers' Association at Columbus June 5 was the adoption of a resolution on the then proposed freight rate increase, which is reproduced on another page.

The association took the necessary steps to become an incorporated body not for profit under the laws of Ohio.

Executive Secretary Guy C. Baker is counting upon a big attendance at the next meeting, July 10, at The Breakers hotel, Cedar Point, Ohio.

Trade Literature.

F. R. PATCH MFG. CO., Rutland, Vt. Several circulars showing pictures with brief descriptions of copers, rubbing beds, saws, planers, jointers, lifting jacks, lathes, drills, polish machines, diamond saws and carborundum machines, floor surfacing machines, etc.

H. B. SACKETT SCREEN & CHUTE CO., Chicago, Ill. Catalog 31, discribing mine ore and industrial cars, and elevators, screens and buckets; 7x10 in., 66 pages, illustrated, two colors.

THE TROW AND HOLDEN COMPANY, Barre, Vermont. "Barre Stone Working Tools"; 6x9 ins., 76 pages, 3 colors, illustrated. Describes pneumatic hammers and parts of surfacing machines, hand cutting tools, sharpeners' tools, supplies, etc.

THE SALES FORCE of the Lakewood Engineering Company held a very enthusiastic and successful meeting at the main plant in Cleveland the first week in June. Sales representatives from all over the United States gathered together and discussed with the sales, production, purchasing and engineering executives the present day problem of serving the construction and industrial fields. Over 100 attended the daily sessions and the Lakewood spirit of co-operation, service and good fellowship was ever present.

Pit and Quarry

SAND ▪ GRAVEL ▪ STONE

HANDLING ▪ CRUSHING ▪ SCREENING ▪ WASHING

V—II—8

The Largest Agricultural Limestone Producers

USE

The Bradley Three Roll Mill

This mill is in use by more large producers than any other machine made—produces more material and at a lower cost.

No auxiliary machinery or screens needed to procure the very finest finished product—takes rock ¾" in diameter and reduces to shipping fineness in single operation.

The Demand for Finely Ground Limestone Is Increasing. Why Not Prepare Now?

Send for Catalog No. 42—Our Engineering Dept. Is at Your Service

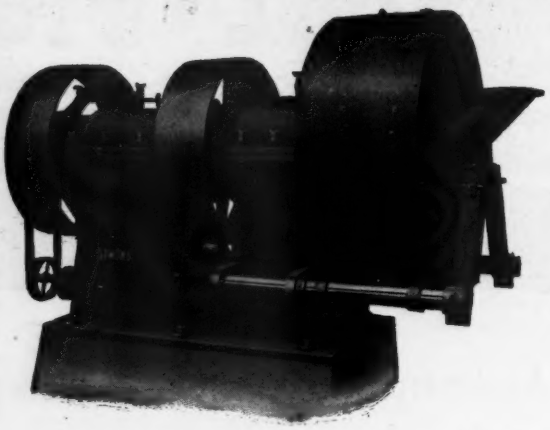
Bradley Pulverizer Co.

BOSTON **London** **Works—ALLENTOWN, PA.**

JULY, 1918

Table of Contents - - Page 17
Index to Advertisements - Page 17

SYMONS DISC CRUSHER



READY FOR IMMEDIATE DELIVERY

Questionnaire Sent to All Users, and One of the Answers

Q. Size crusher this report covers? Ans. *48 inch.*
Q. Kind of material crushed? Ans. *Limestone.*
Q. What moisture in material? Ans. *No Record.*
Q. How long have you operated crusher? Ans. *3 years.*
Q. What is size of feed? Ans. *4 inches.*
Q. What is size of product? Ans. *1½ inch.*
Q. What horsepower does it require? Ans. *65.*
Q. How many tons per hour does it crush? Ans. *80 to 100.*
Q. How many tons do you crush per pair of discs? Ans. *750,000 tons.*
Q. What percentage of time have you lost on account of breakage? Ans. *None.*
Q. Give your opinion of this crusher as compared to rolls. Ans. *Would not use rolls.*
Q. Give your opinion of this crusher as compared to a jaw crusher. Ans. *Superior to Jaw crusher.*
Q. Give your opinion of this crusher as compared to a Gyratory crusher. Ans. *Superior to Gyratory crusher.*

Signed *Name on Request.*

Many more like this, also reports of the success of the crusher on different kinds of material.

Also built in sizes 18 in., 24 in. and 36 in.

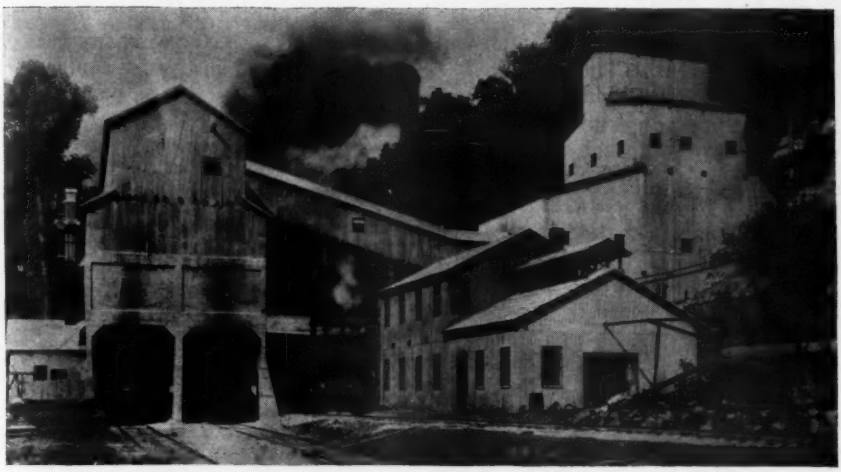
Manufactured and Sold Only by

Chalmers & Williams

CHICAGO HEIGHTS, ILL.

Pit and Quarry

Vol. 2 Chicago, Ill., July, 1918 No. 8



PLANT OF THE LOUISVILLE CEMENT CO. AT MILLTOWN, IND. ROCK CRUSHER ON THE HIGH SIDE OF THE HILL AND SCREENING HOUSE OVER THE LOADING TRACKS. MACHINE SHOP IN THE FOREGROUND AND POWER PLANT IN THE BACKGROUND.

Works Two Qualities of Stone

Speed's Quarries Produce Material for Crushed Rock, Agricultural Limestone, Lime, Portland and Natural Cements and Cement Mortar

By A. W. Williams

ONE OF THE MOST modern plants in the central West is that of the Louisville Cement Company's stone plant at Milltown, Ind., which manufactures crushed rock, ground agricultural limestone, burned lime, etc., cement manufacturing being conducted at the other plants at Speed's, Ind. The Milltown plant has now been in operation for about five years—that is, the new plant which took the place of one that had been in operation for a number of years—while one of the older plants is still operated as an emergency mill principally. The J. B. Speed Company, of Louisville, is sales agent for the output of this plant, as well as those at Speed's.

TWO QUALITIES OF STONE

The large quarries are located on a high hill and are divided into two benches, there being about a 150-foot fall. The upper bench produces low calcium stone for crushing, its depth

being about 65 feet, while the high calcium stone on the lower bench is about 85 feet lower. The former is shunted on a direct level to the crusher plant, while the latter is hand sledged, picked and loaded on small trams which are transferred by mule and cable to the lime kilns, which are about 2,000 feet from the crusher, and on a lower level.

This lime plant is equipped with two No. 2 gas producer kilns, the largest in the country, and have a capacity of 1,250 bushels each for every twenty-four hours. The rock as brought in on the cables is dumped into a large bucket, which holds a number of trams, and this is automatically hoisted to the tower and dropped. This mill is operated by electricity from the main crusher plant.

In addition to the main crusher plant and lime plant the old relief plant has a fair capacity, and is equipped with three old-style vertical kilns, this entire plant also being operated by electricity from the company's main power plant. The main crusher plant is operated by direct drive, direct from the power plant to the crushers, while the screen house is operated by electricity.

Equipment

Reaching the rock stratas is a bit difficult in these quarries, due to the roughness of the land, which makes the ordinary stripping process hazardous. Instead of stripping with steam shovels the company removes from 1 to 10 feet of earth by means of hydraulic pressure, the pipe having a 175 pound nozzle pressure, and driven by a Dean pump. Drilling is handled with cyclone well drills and Ingersoll tripod drills. One steam shovel is used in the crusher quarry, this being a Marion 75. Two locomotives, one a Vulcan and the other a Porter, both narrow gauge, and forty 6-yard Continental cars are used in transferring material from the crusher quarry to the crusher, which is on the same level.

All told, the company has about five miles of railroad, including narrow and standard gauge tracks. Two bridges were built in order to bring a standard gauge track in from the Southern railroad for loading out lime and crushed rock, the company not operating any standard gauge equipment, and using Southern cars, pulled from the private spur by Southern engines.

Crushing House Below Quarry Floor

The crushing operations in this plant are fairly simple. The rock comes in on the quarry level at the top of the crusher plant, which is built on the side of the hill so that the material works down through the plant largely by gravity from elevation to elevation. The rock is dumped from the trams directly into a No. 12 Gates crusher, passing through a sixty-inch screen and going to a No. 7½ or No. 5 Gates crusher, according to the size wanted. The screen used in the crusher house is a 60-inch, in three sections, while two 40-inch screens, each in two sections, are used in the screening house, which is a short distance from the crusher. These screens are all Allis-Chalmers, and a No. 2 pulverizer of the same make is found in the crusher plant for manufacturing ground limestone.

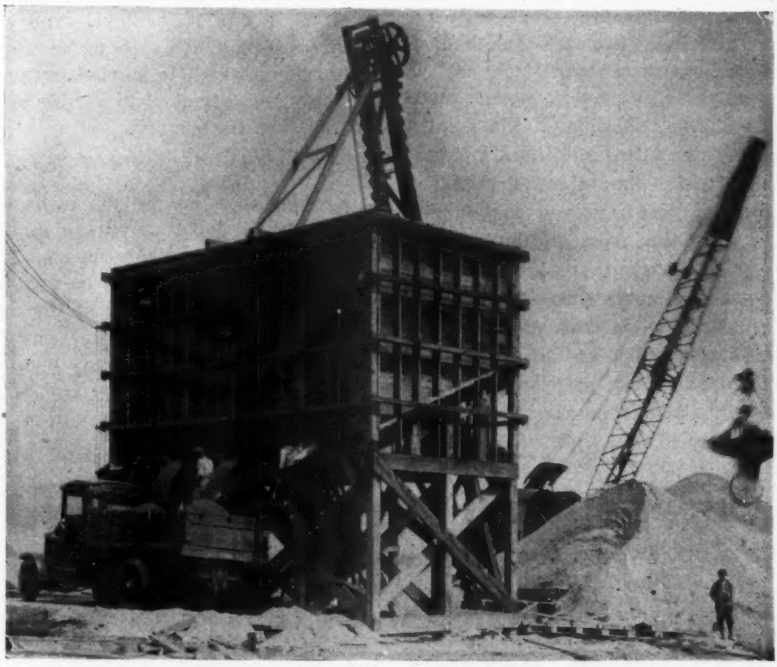
Compressed Air Operates Stone Spouts

From the crusher the stone is carried to the screen house by a covered-ever belt conveyor, this belt being 32 inches wide and 120 feet from center to center; that is, from the crusher to the screen house. The conveyor equipment is of the well-known Robbins make. The screen house is of concrete and corrugated iron, while the entire plant is of the same construction. However, concrete enters strongly into the construction of the

screen house, which is built high enough to allow two loading tracks to enter under the lower screen, so that rock may be dropped directly from the bins to the cars on the track. Instead of operating the hopper drops by hand, as is the rule in most plants, these drops are operated by compressed air, which is a safer and quicker method of opening and closing.

Power Plant

The power plant is equipped with boilers in two units, one unit being 250 h. p., while the other is of 200 h. p., using Babcock & Wilcox boilers. Two engines capable of a total of 425 h. p., are in service, one of these being a 350 h. p. Hamilton Corliss, and the other a 75 h. p. Buckeye. The generator is a 350 K. W., made by the Allis-Chalmers company. A large Laidlaw, Dunn & Gordon air compressor is operated in the power plant to furnish compressed air for the drills and also



For Better Service

UNLOADING its boat with a clamshell bucket and using the same machine to load motor trucks didn't seem to be the right thing to do. It cut down the efficiency of the system, for the Lake Sand & Gravel Co., Detroit, Mich., is always in the vanguard of progress. So a four-in-one storage bin was built and a loader bearing an endless chain of steel buckets installed to keep the bins filled. The picture tells the rest. Now if the clamshell does any second-handling work, it is when loading trucks in addition to those being loaded at the bin. Acknowledgment is given the Federal Motor Truck Co. for the use of the picture.

for the valves operating the hoppers in the screen house.

Runs Own Commissary

The crusher plant has a capacity of 1,200 tons of rock every ten hours. A total of 150 men are employed on an average. The company operates a small industrial city of its own, having built homes for its employes in much the same way as mining concerns and large lumber concerns build homes for workmen, while it also runs a commissary or general store for the benefit of its employes.

Outside of the relief plant and lime plant five buildings are bunched at the crusher, these consisting of the crusher, screening house, power plant and machine shop and blacksmith shop, the two latter adjoining and connecting, while the others are placed far enough apart to prevent any chance of fire spreading from one building to another, although there is very little wood used in their construction. On the south side is the crusher, the screen house being on the north, the power plant to the east and the mechanical buildings on the west. The blacksmith shop and machine shop are very important divisions of the operations, and are equipped to handle almost any sort of work except welding, which is sent over to the plant at Speed's.

Separating the high calcium rock for lime burning entails considerable handwork in sledging out to the proper sizes, hand-picking, etc., so that only the best grades are sent to the kilns. However, the fact that one section of the quarries runs considerably higher in calcium stone makes this comparatively easy. Again, the high calcium rock is in the lower level, and close enough to the kilns to make a very short haul, which is started by mules, the cars being hooked to a cable at the entrance to the quarry.

Keeping Men on the Job

Keeping men on the job is no easy matter in an isolated village district. It is impossible to keep the men from going to the larger towns on pay day, but by keeping liquor out of the camp things are made much better, and this is possible where a company owns all the land near the village, and is enabled to keep bootleggers out.

Effect of the Freight Rate Increase

TO ADD ACCEPTANCE of the freight rate increases on sand, gravel and stone called for in General Order No. 28 would seriously cripple those industries. Many plants might be put out of business, because all are producing a low-priced material at small profits, and freight rates are of equal importance with efficient plant operation and general management. The recent 15 per cent advance was about all the contractors could stand; the new increase amounts to 40 to 70 per cent, because of the average short haul.

Director-General McAdoo has put acceptance of the June 25 increase as a patriotic duty. Producers of these materials are by character 100 per cent patriotic and as a whole have suffered severe loss of business because of the war, in order to keep their organizations intact in the face of decreased markets and greatly increased expenses. The general sentiment is one of helplessness. In a patriotic way operators feel that they could render more substantial aid to the conduct of the war if allowed to do business under war rulings that offer

Freight Rate Advance.

GENERAL ORDER NO. 28 provided for a 25 per cent increase which took effect June 25 on all commodities in general, but road building and other heavy materials are given special treatment, the advances being as follows:

Stone, natural or artificial, for building purposes, 2 cents per 100 pounds.
Stone for road work, sand, gravel, 1 cent per 100 pounds.
Brick, cement, and plaster, 2 cents per 100 pounds.
Lime, 1½ cents per 100 pounds.
Coal, 15 to 50 cents per ton.
Coke, 15 to 75 cents per ton.
Iron ore, 30 cents per ton.

a fifty-fifty chance for existence rather than by shutting down or delivering on present contracts at a loss.

It certainly is not the aim of the government to impose undue hardships upon the production of materials so necessary as sand, gravel and stone, so that it is most likely in issuing the rate advance order, the conditions in these industries were not understood. Believing this, the producers, through their state and national associations, have sought to enlighten the government's departments in the hope that a postponement or suspension of the order will be made. The resolution adopted by the Ohio sand and gravel organization is typical of many others sent to Washington and is here reproduced:

RESOLVED, by the members of the Ohio Sand and Gravel Producers' Association at a session thereof held at Columbus, Ohio, June 4, 1918, that with due regard to the demands made by the national emergency on individuals and industries to accept grave and unusual burdens, we are earnest in our conviction that a freight increase so drastic as to be in effect prohibitory can hardly be justified; that when such increase is relatively immoderate, comes unheralded and does not take into consideration existing contracts, it is in effect fatal to industries already staggering under the exactions of war.

RESOLVED, that it is not fair to an industry which has patriotically responded to every call of the Government in the purchase of Liberty Bonds, War Saving Stamps, Red Cross, Y. M. C. A. and K. of C. contributions, in the payment of all taxes, to overwhelm it with an additional tax under the guise of prohibitive transportation charges. Be it further

RESOLVED, that the imposition of a flat twenty-cent per ton increase on sand and gravel, recognized as a wartime essential by the government in its preferential ruling, involving as it does the least hazard to the carrier as well as the least attention, is unfair when compared with less increases on other commodities involving greater hazards. And be it further

RESOLVED, taking in consideration of the fact that the average haul of sand and gravel is short, the flat twenty-cent per ton increase, added to the so-called fifteen per cent increase, is in effect practically a one hundred per cent increase. Be it further

RESOLVED, that the secretary spread this resolution upon the minutes of the Association and send copies thereof to the United States senators from Ohio, to such congressmen as would be interested therein, to the U. S. Railroad Administrator, and to the Interstate Commerce Commission.

The advance was made solely to assist in the much needed increase in railway earnings. The movement to control commodity markets is spreading and government domination of production and distribution, and of prices, is the outstanding business feature.

On July 10 protests will be heard in the office of L. W. Page, Director of Public Roads, by a committee of which Mr. Page will be chairman. State highway officials, contractors and material men have been asked to be on hand with figures showing how the increase will affect present contracts. Secretaries E. Guy Sutton, of the National Association of Sand & Gravel Producers, and A. P. Sandles, of the National Crushed Stone Association, will be present. In Ohio alone the advance will cost contractors approximately $1,000,000 and will drive many into bankruptcy.

VERY GLAD to get PIT AND QUARRY and enjoy reading it very much.—Champion Sand & Gravel Co., Denver, Colo.

Fig. 1—Stone is dumped on railroad iron grating having 14-inch squares. Short conveyor handles ballast material; long one feeds to screening machine shown in picture below.

Fig. 2—Double strand roller chain screening machine drags stone over tapered screen bars, for the purpose shown in picture on the opposite page.

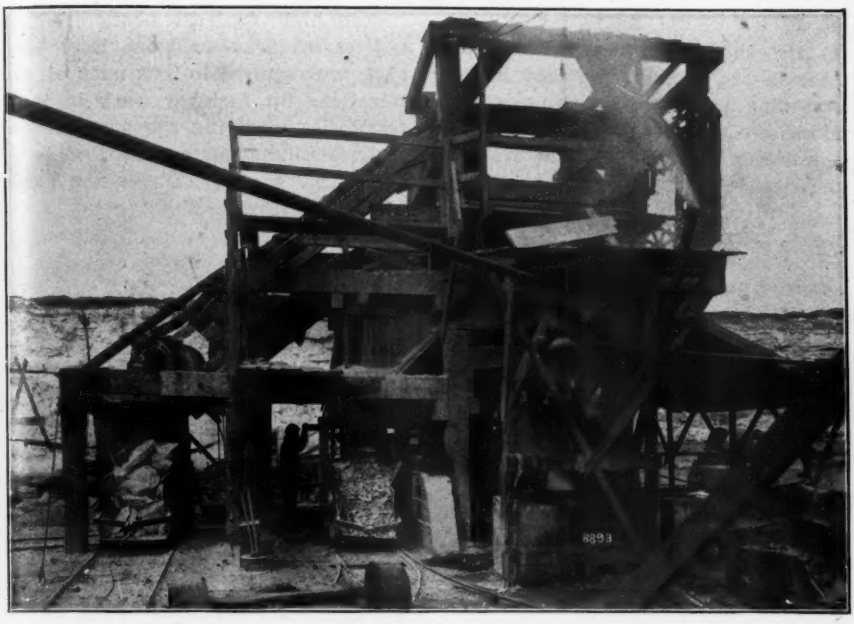


Fig. 3—Bin under tapered screen bars receives material under five inches, which goes to crushing plant. Larger stones, rejected by bars, go to the lime kilns.

Stone for Two Uses Is Sorted and Screened by Machinery

Thomasville Crushing Plant and Lime Kilns Have Rock Separating Arrangement Embracing Several New Features.

NEW FEATURES in the design of the Thomasville Stone & Lime Company's plant at Thomasville, Pa., include the separation by machinery of the large stones, which are fit for the lime kilns, and screening out of the small stuff for the crushing plant or for ballast. The three pictures show a stone-sorting or screening arrangement that is unusual in connection with quarry work.

Figure 1 shows a grating onto which the stone is dumped by quarry cars and on which it is fledged by hand to reduce some of the extra large pieces to a size to pass through the 14-inch squares in the railroad iron grating. The stone is then drawn from a large steel-lined hopper out to two inclined pan conveyors. The left-hand or short one delivers a load of a grade of stone that is used for ballast and crushed stone work.

The long pan conveyor feeds to a double-strand roller chair screening machine, which is illustrated in Fig. 2. This machine drags the stone over tapered screen bars which can be seen in about the middle of the picture, and delivers stone under four or five inches to a small bin. The larger stone passes over the grating and is eased down an incline and delivered with a minimum drop to the skip car shown

at the left of Fig. 3. This view (Fig. 3) also shows very clearly the difference in the product delivered by the screening machine. The two skip cars are shown ready to run up the incline, one to the lime kilns and the other to the crushing plant.

CHANGED FROM HAND-LOADING

The feature of this plant was the change from hand-loading of cars to small steam-shovel work, and the number of pieces of stone larger than 14x 14 inches run small enough, in proportion, to enable them to spread economically on the grating for delivery to the pan conveyors. The rapid filling of the skip cars also speeds up the production to the lime kilns and crushing plant, and the storage capacity of the large hoppers into which the quarry cars dump, together with the amount of stone carried on the pan conveyors, insures an ever-ready supply to the skip cars leading to the plant.

This plant has been in operation day and night for about 2 years and is still in excellent condition, due to the very heavy proportioning of all moving parts and slow speed of the moving parts.

It was designed and built by the Link-Belt Company, of Philadelphia and Chicago.

Oil and Coal Products in Road Work Limited.

PETROLEUM, asphalt, or tar products wanted for the construction, maintenance, or reconstruction of roads will be delivered only after approval of the application by a committee representing the United States Fuel Administration and the Office of Public Roads of the United States Department of Agriculture. This announcement is made by officials of the two Federal agencies.

State highway departments, to which notices of the restrictions have been sent, are required to pass upon all applications for highway work in their territories involving the use of these materials. Applications are then to be sent to L. W. Page, Director of Office of Public Roads, Washington, D. C. Mr. Page is chairman of the committee which will consider the necessity of the material being supplied and will make recommendation.

The government's action is not intended to restrict maintenance work, but rather to provide against deterioration of roads that will soon be improved on a vast scale leading to government warehouses.

Council Will Control Road Work.

ROAD AND STREET work in future will be controlled by the United States Highways Council. This body will seek to prevent delays, financial losses and uncertainty in taking up each highway problem in its turn with a separate government agency. It will keep in close contact with each state highway department. All highway projects in which the government is interested will be taken up through the state commissioners.

The council consists of L. W. Page, U. S. Director of Public Roads, chairman; Col. W. D. Uhler, war department; C. G. Sheffield, Fuel administration; G. W. Kirtley, Railroad administration; R. L. Humphrey, War Industries administration, and J. E. Pennypacker, secretary.

It urges conservation of money, tranportation, labor and materials in the following rank of importance: Maintenance of existing streets and roads; reconstruction of badly damaged streets and roads, and new construction only where vitally necessary.

Agricultural Ground Limestone

BY RICHARD K. MEADE

Chemical and Industrial Engineer, Baltimore, Md.

This Isn't a Cotton Field—It Takes Limestone to Grow Clover Like This

—Courtesy of College of Agriculture, The Ohio State University.

WHERE LARGE PULVERIZED stone operations are to be undertaken, a report on the deposit should be made by a competent expert. Such a man can advise as to not only the quality of the beds but the quantity available and make suggestions as to the proper working of these to obtain the best product. He can also advise as to the legal requirements for the sale, commercial possibilities of the plant, etc.

Equipment Necessary

Coming to the question of the equipment necessary to produce agricultural ground limestone, a large variety of crushers, mills, etc., are available for this. Usually the preparation of this product will be in two stages, (1) crushing and (2) grinding, although there are mills advertised which will take stone which has been broken down to hand size with a sledge and reduce this directly to a fair product. These mills are, however, only intended for small outputs, and when a well-equipped plant is desired which will turn out a good product economically, the process can be most efficiently conducted in two or more stages.

The mills most used for the preparation of ground limestone are hammer mills, Fuller-Lehigh mills, Griffin mills, Raymond mills and ring roll mills. Probably the most popular installation for the preparation of agricultural ground limestone is a hammer mill. The stone is first passed through a crusher of either the jaw or gyratory type and reduced to pieces from 2 to 2½ inches and under. If desired, the rock may be screened and

only the 2-inch stone used, but this is not necessary. The product of the crusher is then elevated into a bin and fed from this to the hammer mill, or it may be fed directly from the elevator leading from the crusher into the mill if the quantity so fed is regulated to suit the capacity of the mill.

The Hammer Mill

The hammer mill is manufactured by a number of concerns each of whom has some particular modification of the type. In general, the mill consists of a series of short, flat bars or hammers hinged around a central shaft, which hammers swing out as the shaft revolves and beat the material to pieces against grinding plates set around the circumference of the mill. The fully ground material falls through a grid in the bottom of the mill and the fineness is regulated by the spacing of the bars composing this grid.

The product of most types of this mill needs no other screening than this grid. However, a finer and more uniform product can be obtained from all of them by screening and returning the tailings to the mill for grinding. The hammer mill is well suited to grinding to a fineness of ten mesh but is not adapted to giving a fine material. The principal advantage of the hammer mill is that it may be fed with coarse rock and will reduce the same to a finished product.

The Griffin Mill

The type of Griffin mill usually employed for preparing ground limestone is the three-roll Griffin, although where small outputs are desired a single-roll Griffin may be used to advantage. The three-roll Griffin mill consists of three rolls suspended from the cross yoke of a central vertical shaft. This latter is hung from an "A" frame and is revolved by means of a horizontal pulley. When the mill revolves, these rolls swing out against a horizontal ring or die and the material is ground in between this ring and the rolls.

When ground it is sucked up by fans attached to the shaft and blown through a screen, after which it falls down into a chamber below the mill foundation, from which it is conveyed by suitable means. The fineness of the product depends on the size of screen employed, and a product of any fineness from all passing a 10-mesh screen to one of 95 per cent passing the 100-mesh screen can be obtained.

The single-roll and smaller size three-roll Griffin mills require that the stone shall be reduced to approximately ¾-inch stone and under. There is a large three-roll Griffin mill ("Hercules") which will take larger material and reduce to 55 per cent passing the 100-mesh screen, but the output of the latter is probably far in excess of that needed by the quarryman, being about 40 tons per hour.

The Fuller-Lehigh Mill

The Fuller-Lehigh mill consists of a die or ring mounted on a suitable casting, against which four balls are made to revolve by means of pushers. The material is ground between the balls and die. The ground material, as in the case of the Griffin mill, is sucked up by means of fans and blown out through screens into a casing, from which it is discharged by a sweep. The Fuller-Lehigh mill may be obtained in a number of sizes and almost any fineness of product desired may be obtained by altering the screens. The material fed to the mill must be first crushed to about ¾-inch and under, depending on the size of the mill—the larger mills taking coarser feed than the smaller ones.

The Raymond Mill

The Raymond mill consists of four or five rolls which are suspended from a central vertical shaft with cross arms. These rolls are swung out against a ring or die by means of the revolutions of the shaft and the material is ground in between the die and rolls. The finely ground powder is sucked up by means of an exhauster and blown into a cyclone dust collector, where the fine powder settles out of the air and is discharged from the bottom.

Fineness is regulated by the draft of air through the cone. The Raymond mill also requires the material to be crushed to ¾-inch and under before being fed to it. This mill is well adapted to giving fine product but can not be made to give the coarse 10-mesh material.

Road Repairs Necessary to Help Country.

If a "penny wise, pound foolish" policy is adopted—particularly in so far as road repairs are concerned—it will mean that for every dollar saved ten will have to be spent to make up for the destruction that will go on and which will increase alarmingly.

In caring for highways—used now ten times as much as they were a year ago—nothing could fit the case so well as "a stitch in time saves nine."

Unless liberal road repairs are permitted all over the country many highways will be almost beyond use before the summer is over, and they will be absolutely of no avail when winter comes.

What Is Necessary

In order that the roads may not be entirely destroyed or put into a condition requiring complete rehabilitation, the government ought to impress upon states, counties, cities, townships and villages the necessity and desirability of eliminating every mudhole, every depression, by filling in; it should ask that culverts and bridges be kept in a reasonable state of repair, and it should command that every highway should, regularly and systematically, be dragged after every rain, that high spots may be eliminated, low spots filled and the roads made as smooth and safe as possible with this temporary scheme to aid, as far as possible, transportation over public highways.

The Ring-Roll Mill

The ring-roll mill is made in two types, "Kent" and "Sturtevant." Both consist of a vertical ring and three rolls pressed against the inside surface of this by springs. In the former the rolls and ring-roll revolve, while in the latter the ring is stationary and the rolls not only revolve around their own axis, but also among the axis of the mill. The grinding is, of course, done between the rolls and ring.

These mills do not discharge a finished product but are used in connection with some form of screen, the tailings from the latter being returned to the mill. This type of mill will not give nearly so fine a product as the three preceding types even when a screen is used, but is satisfactory for 10-mesh material.

The Tube Mill

The tube mill is also employed to a limited extent for the preparation of agricultural ground limestone. It is not so well adapted for this purpose as the mills mentioned above, however, for the reason that it must be preceded by some form of coarse grinder, such as one of the foregoing mills or by a ball mill. The tube mill

is essentially a fine pulverizer and is therefore not so well adapted to producing economically material of only medium fineness. The large space required for the installation of the mill and the fact that it requires more power in grinding than the other types all limit its use.

Effect of Moisture

In the preparation of agricultural ground limestone, it is not usual to dry the rock before pulverizing nor is this necessary or desirable unless a very fine product is desired. The hammer mills are less affected by moisture than the screen mills. No difficulty will be experienced with coarsely grinding most limestone rock without drying with any of these mills, however, provided the rock is not actually wet and is free from clay. Even with wet rock if the fine material is first screened out and only the coarse ½ to 1-inch material is fed to the mill, very little difficulty will be experienced from clogged screens, etc.

(Continued in the August number.)

Road Material Producers on Favored List to Recieve Cars

UNDER THE RULING, recently announced, of the Car Service section of the railroad administration crushed stone, slag, sand and gravel and other highway materials directly follow coal, coke and ore on the preferential list to receive cars. The ruling will apply at all times except when the cars are more urgently needed for coal, coke and ore. The regulations are here given:

1. Open top cars, suitable for such traffic, should be furnished preferentially for the transportation of coal, coke and ore.

2. Available open top cars, not suitable for the transportation of coal, coke or ore, may be furnished for the transportation of stone, sand and gravel, and when so furnished shall be used preferentially for highway maintenance materials.

3. Open top cars, suitable for the transportation of coal, coke and ore, and available on coal, coke or ore producing roads in excess of the demand of such commodities, may be furnished for the transportation of stone, sand and gravel, and when so furnished shall be used preferentially for highway maintenance materials. The return movement to mines or ovens should be utilized wherever practicable in furnishing car supply for stone, sand and gravel. Every endeavor should be made, consistent with keeping up the production of coal, coke and ore, to furnish shippers of stone, sand and gravel with a minimum of forty per cent of their normal weekly transportation requirements.

4. Roads which are not producers of coal, coke or ore must not use foreign open top equipment for stone, sand or gravel shipments, except for one load in the course of the return movement to mines or ovens.

5. Where the transportation needs of essential road construction or maintenance projects cannot be met by car supply furnished in accordance with the above rules, the state, county or municipal officials in charge of the work, should, through their proper state highway department, apply to the Director of the Bureau of Public Roads, United States Department of Agriculture, Washington, D. C., for assistance. Such applications will be considered by representatives of the Department of Agriculture, the War Department, the War Industries Board, the fuel administration and the railroad administration, and in accordance with the recommendations of such representatives, the Car Service Section will endeavor to furnish car supply necessary for approved essential road construction or maintenance.

Miltary Highways

By Hon. LOGAN WALLER PAGE

Director, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture

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EDITOR'S NOTE: Lack of space prevents the reproduction in full of Mr. Page's article. We have endeavored, however, to select such portions of it as will make clear the Director's recommendations of a highway system adequate for wartime needs.

IN THE CONDUCT of modern warfare we now know that the highway plays no small part, because, in addition to its use as an avenue for marching troops, supply wagon trains, cavalry and artillery, it affords a means of rapid transport that is easily, quickly and economically constructed to carry heavy units of artillery and accessories, and the moving of large numbers of troops quickly.

The value of possessing a comprehensive system of military highways becomes at once very apparent when we hear that France was practically saved by her ever-ready system of roads and the great number of available motor busses, which quickly conveyed her troops to the point of attack. But in this connection we must not confuse the fact that the system as now completed at the French fighting front was not complete to start with; but it consists in considerable part of extensions to main arteries which were built years ago according to a program having the civil as well as the military roads as a basis of design.

Must Consider Civil Needs

This, in fact, is the only basis upon which any comprehensive system of highways can be designed, and any system not based upon the civil as well as the military problems involved is not only uneconomical but unstrategic, because the present war has thoroughly demonstrated that the organization of all civil as well as military elements is absolutely essential to the rapid production of large supplies and their speedy delivery. In this latter highways are great factors.

Our problem is not to develop a local network over small areas, but to provide, first, a series of main arteries between the large centers. If we should undertake to develop highways on the same scale that France has, there would be as many roads in New York and Pennsylvania as there were in Germany, and as many in New England as in Old England, Scotland and Wales. The development of such a system in detail would be unwarranted by our present economic requirements in times of peace.

Should Form Large Open Net

Further, the local construction of so close a network of roads would not be warranted over any one area to the exculsion of others. It appears plain, then, that the underlying principal of road location in a large way is to provide, first, the large open net of through roads over the entire area of boundary, choosing first those areas most open to attack.

Certain areas are obviously within this class, such as (a) the area about Long Island, comprising the New England states and New York; (b) the area about Cheaspeake Bay, comprising much of New Jersey, Pennsylvania, Maryland, Delaware, Virginia and North Carolina; (c) the Pacific Coast area of three states; (d) the Mexican border, comprising the southern part of Texas, New Mexico and Arizona; (e) the Great Lakes area, comprising parts of the Lake states; and (f) the Gulf area, comprising parts of the southern Gulf and Atlantic states.

Through Roads Necessary

In addition to a large network of roads, connecting the centers of population in these areas, there should be through roads leading inland to important centers of manufacturing and supply. The number of these necessarily depends upon economic conditions. Roads should connect the Pittsburgh, Cincinnati, Detroit, Chicago, Birmingham and other big industrial

(Continued on page 263.)

EDITORIAL

Pit and Quarry

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Co-operation and Fair Play

THE PRESIDENT of a quarry company writes as follows:

The writer has been in the stone business for more than twenty-five years, handling building, dimension and crushed stone. It has been a continuous fight all of this time to make even a meager percentage of profit, and I attribute this to the fact that quarrymen do not become acquainted with one another; do not visit and compare notes, etc., as they should.

Gravel and crushed stone men must play fair with one another. They must not be at one another's throats, for it is only they who will suffer.

This is only too true, and it is a plea for fair play and the healthy co-operation of those having common interests. Business conditions are abnormal now, especially in the stone, gravel and sand industries, but this feeling of fair play and co-operation is needed now more than ever.

It does not mean a restraint of business competition, nor of illegal combines to make the public pay more than a fair price, nor does it mean that the small operator must be throttled. It is such practices as these that have brought about so many laws affecting business until today we are suffering from "too much law."

The kind of co-operation of which this quarry owner writes is that of bringing about a better knowledge of producing and marketing quarry and pit products, that will help the general conditions and bring about a better feeling and understanding among operators.

Fair play, today more than ever, is a demand in the business world. We are engaged in a great war and struggle to establish fair play and democratic freedom among the nations of the world. If we are to win this war, as we must, we must practice fair play in our dealings with one another at home. In other words, we must practice what we preach.

It is true that unfair practices in the end reflect upon those who indulge in them. Quarrymen and pitmen in the past, and even today, in some sections of the country have resorted to cut-throat practices to their own detriment. All business should be upon the foundation of selling products at cost plus a fair profit. The public expects to pay such a price, but on the other hand the public is not willing to pay prices that mean excessive wastes in production.

First of all there must be co-operation in reducing costs. This means uniform cost-keeping systems, and

with some definite knowledge of costs it will be possible to eliminate those methods of production that mean only waste. It is hardly possible for every operator to have exactly the same cost-keeping forms. This is not necessary, but the fundamentals of cost-keeping for any industry are the same, thus it will be possible to make comparisons that will mean something. It is by cost-keeping that production is speeded and cheapened.

Results having been accomplished in this line, the next feature of the industry to consider is selling, which includes the giving of credit. It is in selling that the worst practices are employed. Then, too, many quarrymen and pitmen have trouble in extending credit. These things can only be bettered by active co-operation of all operators. There should be a credit department of the National Associations that would make reports on the financial standing of all purchasers of sand, stone and gravel. This association could also set standards of salesmanship as well as units of weights and measures.

PIT AND QUARRY offers the medium for operators to get together. It is publishing articles in every issue that are aimed to be of value not only in producing but also in selling. In addition, it welcomes letters and articles on these subjects from its readers, and comments upon the articles published. This journal will, we hope, be of assistance in giving standard cost systems and adopting the best methods and machinery for developing and operating quarries and pits. As the data can be collected it will go into the subject of deriving fair prices and will discuss the ethics of selling. The editors believe in fair play and co-operation.

Military Highways.

(Continued from page 261.)

districts with the coasts. The primary system must be designed in accordance with the demands of traffic and act as main arteries for the secondary system. The secondary system should be selected as feeders and connections to the primary system. It has been calculated quite accurately that twenty per cent of the highways in America carry eighty per cent of the traffic.

The design for highways improvements under ordinary conditions is not beyond a reasonable determination after a careful study of the traffic by means of traffic census and knowledge of the country to be served. The military road should be the most economical one, just as in the case of the selection under peace conditions. It appears, from the most reliable and first-hand sources of information, that water-bound macadam, telford, V-drains and stone base are the most effective purely military types of construction.

The traffic carried by the Bar-le-Duc-Verdun road was astounding in its wear and could not be halted. The question of restoration of road surface called for much ingenuity and was a matter of extreme expediency. Just what our American higher types of pavement would have suffered is hard to determine, as none of them is found to any great extent in the European zones of activity. Many of them would doubtless stand heavy pounding for a longer time than the macadam, but when rupture came the invariable requirement of immediate repair would force resort to materials and methods capable of rapid and effective application. It is seen at once that the exigencies of rapid construction, immediate serviceability and simplicity of methods and materials throw us back upon the lower rather than the higher types of road surfacing.

The general conclusion from these observations is that the planning and use of highways for military purposes introduces no new or essentially different principles and only a few altered assumptions. These assumptions are all in the direction of improved and heavier construction in most localities.

For explanation of pictures see following page.

West Virginia Glass Sand

Government Considers Suitability of Material for Optical Lens Manufacture—Berkeley Company's Operating Methods.

Explanation of Pictures on Opposite Page

Above—(At left.) Quarry of the Berkeley Glass Sand Co., showing the tunnel through the hard rock. (At right)—Loading glass sand in the quarry. Note the irregular shape of the blocks and the method of loading. Below—(At left)—Heaps of washed sand draining before going to the dryer. (At right)—Sand dryer, consisting of banks of steam pipes. Dry sand falls in thin streams onto a belt conveyor halfway between the brick wall and the ground.

A SHORTAGE of field glasses to equip officers in the army and navy has required the Government to undertake seriously the problem of making optical glass. A silica sand carrying less than 0.015 per cent of iron oxide is required. Deposits of pure quarts sandstone along the east side of Warm Spring Ridge, between Hancock, Md., and Berkeley Springs, W. Va., have long been quarried for glass sand. The industry has become one of considerable importance in the district, with an output in 1916 of 300,454 tons of glass sand, valued at $362,357, besides which sand was sold for building purposes, steel molding and engine sand. The output and value will be considerably higher in 1917, but figures are not yet available.

By R. W. STONE
United States Geological Survey

BERKELEY SPRINGS is in Morgan county, at the southern terminus of the Berkeley Springs branch of the Baltimore & Ohio railroad. All of the five quarries there are on the hillside above the railroad and within one-half mile of it.

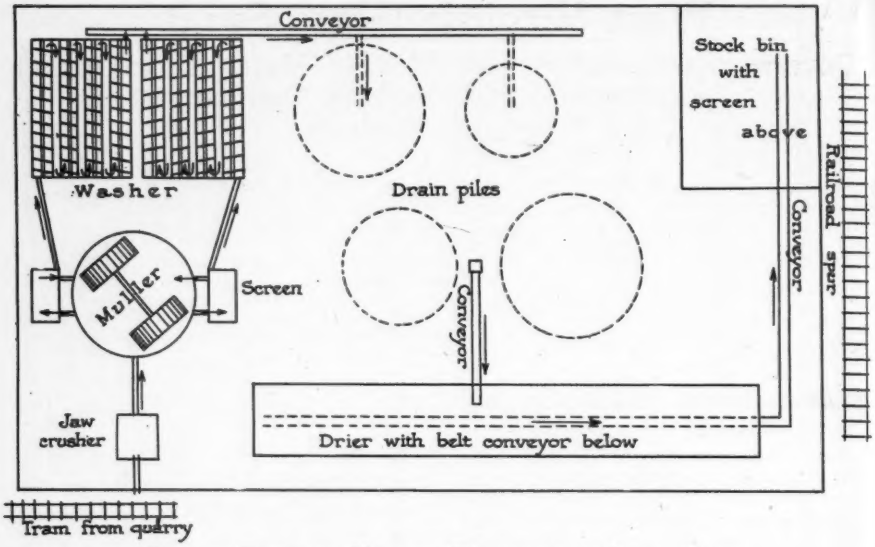
Glass sand is derived from Oriskany sandstone, which outcrops along the east side of Warm Spring Ridge as part of a monoclinal series of beds between a syncline of carboniferous rocks forming Sleepy Creek Mountain on the east and an anticline exposing Medina sandstone in Cacapon Mountain on the west.

In the vicinity of Berkeley Springs the Oriskany sandstone is 150 to 200 feet thick. The upper 20 feet is hard and is not quarried, being left as a wall which, as quarrying progresses, serves more and more to protect the highway from blasting in the pits behind it.

This pure white quartz sand is a beach or near-shore deposit, and its purity, freedom from mud and other fine detritus, the uniform size of its particles and their sub-rounded character indicate long-continued sorting action at this part of the shore. The size of the grains is well adapted to glass sand, practically all passing a screen having 40 meshes to the inch and 25 per cent passing 60-mesh screen.

At the surface the rock is indurated or harder than a few feet below the surface, and it is slightly glazed. This is probably due to solution and redeposition of silica between the grains. Below the surface the grains are loosely cemented by lime, and the rock is commonly so soft that it readily crushes to individual grains.

Blocks blasted from the ledge are broken down with no difficulty by the use of sledge hammers to lumps that one man can handle. Because of the softness, although it occurs in beds,



PLAN OF BERKELEY MILL FOR WASHING AND DRYING SAND

the rock breaks in irregular blocks rather than in squares or slabs. Much of the rock broken by a big blast is so fine that it is loaded in tram cars with a shovel instead of the customary fork.

Near the surface the larger joint planes in the sandstone are discolored with soil and vegetable stain. This can be removed by washing and does not disqualify the rock for use as glass sand.

In 1917 five companies were operating eight quarries and seven mills. The method of operating is practically the same in all. Rock is drilled by compressed air or steam drills, broken from the ledge in large masses with explosives, loaded by hand into small tram cars, which are gathered by horse, mule or man power, and sent to the mill, in most cases by gravity. Empty cars are returned to the quarry by steel cable haulage or by a dinky locomotive.

GRADING, CRUSHING, GRINDING, WASHING AND DRAINING

Separation of rock for first and second grade sand is made by hand in the quarries. At the mill the rock is reduced by a jaw crusher to lumps the size of a man's hand and falls from the crusher into a pug mill or muller, where it is crushed to individual grains.

This mill is a metal pan or vat several feet wide and deep, in which two large steel-rimmed stone wheels revolve on a horizontal axis pivoted at the center of the pan. Grinding is done in water and the fine material is washed through the perforated side of the pan into a revolving screen. A stream of water playing on this screen washes the fine sand through it. The oversize returns to the muller for regrinding.

Sand which has passed the wet screen flows to the washers. These are long, narrow, inclined boxes of heavy lumber in which large iron screws revolve. As it is carried up the trough by the screw the sand is tumbled over and over in water. At the upper end of the trough a jet of water washes the sand into a parallel and smaller box of the same length, down which it

flows and is cleaned by knocking against riffles.

Successive passing of the sand through a set of three or four washers thoroughly eliminates all very fine and foreign material. The clean white silica grains fall from the last washer onto a belt conveyor, by which they are elevated and spilled in a heap on the draining floor.

Drying and Storage.

The drained sand is raised by portable bucket-belt conveyor or by a Telfer bucket and dumped direct or by moving belt onto the drier. A sand drier consists of steam pipes in banks of 15 to 20 arranged in tiers one above another. The pipes in the lower tier are smaller and closer together than those above. The banks of pipes are 50 to 100 or more feet long, depending on the capacity required, and are enclosed on both sides with a brick wall.

The drier has a hopper bottom, which directs the dry sand through a slit onto a belt conveyor. From the discharge end of the belt the sand is elevated to concrete or metal storage bins built high enough for their contents to be discharged by gravity into railroad cars.

At some plants the dry sand is screened before storing. The clean white sand is usually shipped in bulk in box cars lined with paper to prevent leakage, and is used for making plate, window, table, prescription and other kinds of glass.

Berkeley Company's Plant.

The quarry and mill of the Berkeley Glass Sand Co. are on the northern edge of the town of Berkeley Springs and about one-half mile from the railway station. The quarry, like all the others, is on the upperside of the road. It is midway of the ridge slope, and the quarry floor is about 150 feet above the valley bottom.

The hard cap rock of the Oriskany formation is not quarried, and the sand pit is entered by a short tunnel through it. The quarry face is about 300 feet high, but the floor is only about 60x150 feet. Drilling is by compressed air. Eight tracks lead to the working face, where small mine cars are loaded by hand. Loaded cars are drawn to the mill by horses.

At the mill there are three dumping chutes, one each for hard rock, grade 1 and grade 2. Hard rock is crushed in a separate mill and loaded direct on cars by traveling belt without intervening storage. This hard sandstone is shipped to Baltimore for making ferro-silicon. Grade 1 and grade 2 sands are separated at the quarry and are milled in separate units. A unit consists of one muller, two screens and eight screw washers.

The company has furnished the government with sand practically free of iron, analyses of which, as made by H. S. Washington and J. B. Ferguson, show 0.025 and 0.016 $Fe_2^0_3$.

The crushers, mull pans, washers and dryers were furnished by the Lewistown Foundry & Machiney Company, Lewistown, Pa. The boiler was purchased from the E. Keeler Company, Williamsport, Pa. The air compressor and drills were purchased from the Ingersoll Rand Company, and the traveling crane from the Northern Engineering Works, Detroit, Mich.

A total of $2,601,000 worth of Liberty Bonds has been taken by the employes of the Westinghouse Electric and Manufacturing Co. The company employs over 30,000 people, and in order to cover the entire works thoroughly from office boy to executive, team captains were appointed, who, in turn, were lieutenants of teams. The members of these teams sold each employe a bond or got a very satisfactory reason for their refusal.

Working Sand and Gravel Pits

IN FORMER ARTICLES the general features of working pits have been discussed. In the May issue the various methods of excavating pits from on top were described. In this article the methods of working pits against a breast are pointed out and comments made as to their economy.

BY D. J. HAUER, C. E.

WHEN WORKING PITS from on top the same machinery used for excavating the product can be used for the stripping, but this is not true in case of working against a breast. If the bank is a high one and the overburden a small percentage of the entire mass, say less than five per cent, then it may be possible to carry on the entire excavation as one operation. With stripping necessary there must be two operations.

If these two operations must go on simultaneously, then there must be two sets of machines used at the bank, making a large capital expenditure. It is for this reason that a large number of banks are worked by hand methods. Even if the sand or gravel is excavated by some type of machine, the stripping may be done by hand.

If the product does not have to be either washed or screened, and the operation is small, then hand methods may be advisable, but in most cases it is not economical for either the stripping or the excavation of the product. A small steam shovel operating against a breast has proven economical, when common labor could be hired for less than twenty cents an hour, and less than a hundred cubic yards were excavated in a day. With wages at thirty to forty cents per hour, excavation can be done economically by machines when the yardage is fifty or less. Such facts as these should be known by owners doing hand work.

IF AN OWNER has a regular output and sale for even a limited quantity of sand and gravel, he can, in most cases, afford to go into debt to secure some type of excavator, for the machine will save enough in labor to pay for itself in a reasonable time. If the business increases, the same machinery will more than likely be able to produce four or five times the quantity with but small additional cost. These facts have been proven in clay pits as well as in sand and gravel banks. Machinery cannot be recommended for small production and only occasional outputs.

It is due to the fact that stripping is frequently limited to a short time in a season, or is very light, that it seldom pays to install the same machinery for this operation as for the excavation of the product. For such stripping scrapers can be recommended, and the remarks made regarding the four kinds of scrapers for pit work in the May, 1918, issue of PIT AND QUARRY are applicable for this operation.

If the stripping is heavy and can be done against a high breast, then the machines to be described for excavating the product can also be used for the stripping, either by duplicating the plant, or by working it for stripping in the off season.

WORKING AGAINST A BREAST

Almost every type and size of steam, electric or gasoline shovel can be used in pits against a breast, but there is one that should be given special mention. This is the Keystone excavator. The body of this machine is modeled after that of a well driller, but it is fit-

ted with a set of spreaders or jack arms to steady and hold it to its work while excavating. A light steel boom in front holds and operates the dipper.

Of the latter there are three shapes. One is known as the skimmer dipper, which is shaped somewhat like a square-cornered drag scraper. In operation the boom is dropped close to the ground, and the dipper skims along the surface taking a cut from the ground. This skimming motion gives the dipper its name. The dipper once loaded, the boom is raised and swung around, dumping the load into a vehicle of some kind. It is by means of this dipper that either light or heavy skimming can be done, so that the machine is well adapted to stripping banks or working out thin or shallow veins of sand or gravel. It even becomes possible to clear off and take out a thin vein of valuable clay, when otherwise when excavated by different machines, the clay could not be saved, but would only prove a source of expense, as it would become mixed up with the product.

The second shaped dipper is called the draw ditcher scoop. Primarily designed for excavating either ditches or trenches, this dipper has proved economical in excavating pits, cellars, etc. It has a hinged motion at the end of the boom and is shaped like a regular steam shovel dipper, but instead of digging away from the body of the shovel and above the grade of the wheels, it digs towards the machine and below the grade of the wheels. This machine could be classed with those working a pit from on top, but inasmuch as the dipper must work against a breast or bank it is proper to discuss its work in this article.

The value of this dipper in stripping operations is that pockets of clay or loam can be excavated cheaply after the main stripping is done. For pit excavation this scoop will allow sand or gravel to be excavated below water level without operating pumps, keeping the machine above the water line.

The third dipper is like the ordinary steam shovel kind, operating in the same manner, so that either for stripping or pit excavation against a breast this excavator can be used. The fact that it is light, of easy traction up and down steep grades and can travel a mile and a half per hour allows the excavator being moved either quickly or cheaply from one part of a pit to another and from the operation of stripping to that of production.

Items Governing Choice of Machine

For excavating pits against a breast the power shovel is, without doubt, the ideal machine. Such shovels are built with dippers of a half a cubic yard capacity to about ten cubic yards, so that the variation gives a wide selection. The size and type of machine to be installed must depend upon local conditions, character of the material, height of the bank, amount to be excavated each day, mode of transportation and whether or not the product must be screened or washed, as well as other features of the work. A large shovel will be needed for loading gravel directly into railroad cars when three or four thousand tons daily must be produced. The large dipper will mean quick loading and the labor item will be kept at the minimum. Irregular loading of a few wagons or some small cars in a day calls for a small shovel.

If the bank has only a reasonable height and trucks are to be loaded on top of the bank to prevent them from being stuck in the pit or to save building expensive roads in the pit, a shovel of fair capacity will be needed, either with a boom of high reach or a special boom built for the work.

There are now on the market some shovels that permit the dipper being taken from the boom and a grab bucket operated on it. For some pits such a shovel possesses special value. If part of the sand or gravel is above the water bearing line, the shovel can be used with its regular dipper to excavate the dry material, while a grab bucket can be used to excavate in the water bearing stratum, thus saving pumping.

Transporting Material to the Plant

In using power shovels some means of transporting the material must be employed if the product is to be screened, washed or stored. If not the shovel loads directly into the delivery vehicle or car. If the material is screened or washed, then the product must be hauled to the screening or washing plant for this purpose, carts, wagons, trucks, and conveyors are used.

One-horse carts are never economical, for with a two-horse vehicle more

than twice the same amount can be transported, while the cost is only slightly increased. Two-horse dump wagons are more economical than the carts, and for short hauls are better than trucks. For long hauls the trucks are efficient.

Small cars pulled by a gasoline engine can handle a large daily output at a small cost. Two trains can keep both the power shovel and the screening and washing plant busy. The size and type of cars to be used must be governed by the grades of the rail and the amount of material to be handled.

Use of Belt Conveyors

Belt conveyors have not been used extensively, except for short distances, for transporting material from an excavator to a plant, but that is no reason why they should not be employed more extensively, especially when the ordinary methods of transportation are so costly. For conveyors the capital expenditure is generally large, but the operating costs are rather low, the belts being a maintenance cost that can be kept reasonable if proper attention is given. The use of conveyors can be recommended when the pits are deep so that a shovel is kept working in a limited area for some days or weeks, thus changing the conveyor line but seldom.

Portable Machines

For limited outputs from pits that must be worked with small capital, there are several methods of working against a bank without using a steam shovel, and with only a reasonable cost for plant and operation. One such machine is the portable bucket conveyor for loading wagons and trucks. This can be used in banks by working the lower end into the bank so that the buckets will pick up the sand or gravel. To make it do this it is necessary to cave in the bank so that the conveyor will keep picking up the material. Two men do this and they also, with shovels, keep the bottom cleaned up, just as is done in picking up a stock pile. These men also look after the operating and moving the wagon loader. The work done is far cheaper and quicker than by hand. There are a number of such machines for sale.

Double Scraper Arrangement

Another excavating apparatus for working against a breast is a double scraper arrangement. Dead men are set in the top of the bank and lines are run from a hoisting engine to the dead men in the drag lines to the scrapers. The lines are so arranged as to pull a load while an empty is going back, thus sand or gravel can be excavated and transported to a car, bins, screens or washer. The hoisting engine is placed at the foot of the bank. This apparatus has been previously described in PIT AND QUARRY.

Another simple machine that can be used to excavate a bank is the Albrecht excavator. The machine is set on top of the bank while the deadman is placed in the pit. The single scraper is pulled up the face of the bank and dumps over the hoist into a wagon or truck.

These are the principal methods and machines that are adapted to working banks to suit nearly all conditions that are usually found. Much that has been written in this series of articles about pits for sand and gravel is applicable to clay and ore pits.

Ware Plant Sold.

THE ENTIRE PLANT and good will of the Ware Sand & Gravel Company, Cincinnati, Ohio, has been purchased by the Ohio River Sand & Gravel Company, recently formed in Cincinnati. The plant has been completely overhauled and is now ready for business. Considerable damage was done to it by the ice in the Ohio river last winter. It is understood that the suction dredge boat, several barges and unloading equipment were sunk. This plant was described in the June issue.

Bookkeeping Articles.

THE SECOND of the series of articles on "Bookkeeping," by Edwin L. Seabrook, begun in the June issue, will not appear until the August number.

WE ARE also very much interested in the advertising matter in PIT AND QUARRY, which we will undoubtedly be able to use to advantage from time to time.—Carpenter & Knight, Morristown, N. J.

DEVOTED as it is to sand, gravel and crushed stone exclusively, PIT AND QUARRY fills an important field.—Geneva Limestone Co., Geneva, N. Y.

ASSOCIATION ACTIVITIES

Makes Important Changes

Agricultural Material Association Plans Extensive Campaign to Increase Use of Product—Organization Changes Name.

THREE SIGNIFICANT MOVES for developing the agricultural stone business throughout the country were planned at the meeting of the Agricultural Lime and Limestone Association, held at Hotel Hollenden, Cleveland, Ohio, June 6. These will include a cooperative advertising campaign, dealing with the shipping question, and appointment of committees to carry out the work of both.

The transportation problem was brought a bit closer to home by the fact that the Youngstown delegation was considerably late in arriving, thus delaying the meeting. While awaiting them an informal discussion was held among the members, in which it developed there is a fast growing field for the product of the organization, because of the increasing favor with which farmers are looking upon the use of limestone for enriching their lands.

At this meeting F. R. Kanengeiser, vice president and general manager of the Bessemer Limestone Company, Youngstown, presided. G. J. Wilder, manager of the organization, told of the results he has obtained in a survey of the pulverized limestone process. He told the members he had received much encouragement towards increasing the membership from firms all over the country. An especially interesting piece of information received through this survey, Mr. Wilder pointed out, was that a member on the Pacific Coast now is preparing to put the product into the citrus fruit lands in the vicinity of Fresno, California.

It was Mr. Wilder's opinion that the Cleveland meeting would be reflected to the advantage of the trade all over the country. He urged united effort in the educational campaign to reach farmers through the cooperative advertising method. He said that it had been found that united advertising will get more space for the money in the various farm journals.

Association Changes Name

From now on the organization will be known as the National Agricultural Pulverized Limestone Association. The move to change the name is the outcome of an action at the previous meeting. The change, according to J. C. King, of the Carbon Limestone Company, Youngstown, and secretary of the organization, was considered best because it was deemed not a good policy to use several different brands of lime. This move has culminated in the decision to have 60 per cent of the product to pass through a 100 mesh and all through a 10 mesh screen. On account of some firms not being equipped with the 100 mesh, the 60 per cent limit was adopted, until all can produce a finer material.

To meet the idea of one brand the first letters of each word in the new name of the organization, N, A, P, L, A, have been combined to make the name of the brand, and this word "NAPLA" will be copyrighted.

Annual Meeting in October

Following adoption of the new name, several changes were made in the constitution of the organization, making for permanence in the association. These include the selection of October as the month for the annual meeting; adopting plans for the promotion of the trade name so as to make it as well known as "Mazda" or

"Uneeda Biscuit"; and that membership in the association shall include any corporation interested in or engaged in the production of lime for agricultural purposes. All members or producers selling a lime product bearing the recommendation of the name NAPLA shall have the backing and support of the association. A provision has been made in the constitution that such product must pass the specification of 60 per cent through 100 mesh and 100 per cent through 10 mesh screens.

Significance is attached to the quantity of material with which the organization can start to do business. It is estimated there are 250,000 tons of limestone available now. According to Mr. King, the Youngstown district alone will produce 150,000 tons this year.

From now on semi-annual meetings will be held on the first Tuesday of July and the first Tuesday of October.

Several companies have been added to the membership at this meeting, some of which were unable to send delegates. Among them are: The France Stone Company, Bessemer Limestone Company, Kelly Island Lime and Transport Company, Ohio Marble Company, O. C. Barber, Marble Cliff Quarries Company, A. & C. Lime Company, Federal Lime and Stone Company, Carbon Limestone Company, and the Michigan Limestone Company.

Election of Officers

Following permanent organization, officers were elected. They are:

President—J. C. King, Carbon Limestone Company, Youngstown, Ohio.

Vice president—W. H. Hoagland, Marble Cliff Quarries Company, Columbus, Ohio.

Mr. Wilder was retained as manager. The Executive committee includes F. R. Kanengeiser, Bessemer Limestone Co., Youngstown, Ohio, chairman; H. E. Bair, France Stone Co., Toledo, Ohio; Henry Angel, Kelley Island Lime & Transport Co., Cleveland, Ohio; J. W. Wirth, Agricultural & Commercial Lime Co., Canton, Ohio, and A. Acton Hall, Ohio Marble Co., Piqua, Ohio.

The first step of the Executive committee will be to have the trade name copyrighted and the association incorporated.

Among those who attended the meeting were: W. M. Brown, France Stone Company, Toledo; F. R. Kanengeiser; C. C. Hall, G. W. Johnston Limestone Company, New Castle, Pa.; G. J. Wilder, manager, Columbus, Ohio; W. P. Kelly, Dolomite Products Company, Cleveland, Ohio; Henry Angel; J. C. King; J. W. Wirth; C. W. Hitchcock, Federal Lime and Stone Company, Cleveland, Ohio; R. H. Minimum and P. C. Hodges, Marble Cliff Quarries Company, Columbus; C. J. Reilly and A. T. McCormack, Sandusky Cement Company, Sandusky, Ohio; C. C. Calvin, Bessemer Limestone Company, Youngstown, Ohio, and Samuel G. Wells, George and Sherrard Paper Company, Wellsburg, W. Va.

To Illinois Quarrymen

ILLINOIS QUARRYMEN, convinced of the fact that to properly cooperate with the government, which wishes to deal with industries as a whole rather than individuals when forming war policies, met at the La Salle Hotel in Chicago, June 26, and took the first step towards what will soon prove to be a strong state association. Such an organization has been greatly needed for some time and the industry in Illinois has suffered by the lack of it.

The utterances of those present at the meeting, and statements made in person and by letter to R. W. Scherer, secretary of the energetic Wisconsin association, who has visited nearly all of the Illinois men to lay before them the necessity of joining their own state organization, are indeed promising. There are bright prospects of the coming of the time when every quarryman in the state will meet, probably in Springfield, break bread and find out what they really already know—that competitors and fellow quarrymen are good, honorable fellows, and that they should have gotten together long ago.

Such a meeting would be a blessing to the industry as a whole and to each man individually. It is by NOT coming in co-operative contact with one

E. J. KRAUSE
President, Illinois Crushed Stone Association

another that unworthy suspicions are born and grow as time goes on. This was the condition of the quarry industry in Ohio, Indiana, Wisconsin and eastern Pennyslvania until by organization the members reaped extensive financial and moral benefits. Their organizations are respected, are consulted about legislative and other measures affecting its members, are strong enough to protect themselves from encroachments upon their rights, and are able to put through just, constructive measures for general improvement. Nearly every big industry is organized and the stone men must become so. Co-operation is no longer ridiculed by men of vision. Every state in the Union should organize, and together join the National association to represent them in problems of national importance. Of these, there are aplenty these days.

Illinois has good reason to look forward to a vigorous, influential state association, for her quarrymen are individually progressive. Several of them have contributed much in time and money for the good of all. Now that the movement is so well started every man should add to its momentum by resolving to make whatever sacrifices are necessary to get their association firmly launched.

New Officers

The new officers are of this type and deserve the unqualified support of every member. They are as follows:

President—E. J. Krause, Columbia Quarry Co., St. Louis, Mo.

Vice-President—J. J. Sullivan, Dolese & Shepard Co., Chicago, Ill.

Treasurer—A. J. Sullivan, United States Crushed Stone Co., Chicago, Ill.

A secretary will be selected later who will give all of his time to the association, under salary, and be located at Springfield.

The board of directors also chosen consists of J. A. Donovan, chairman, Superior Stone Co., Chicago; J. J. O'Laughlin, A. C. O'Laughlin Co., Chicago; Daniel Foley, Brownell Improvement Co., Chicago; F. W. Stolle, Casper-Stolle Quarry & Construction Co., E. St. Louis; and W. S. Charles, Charles Stone Co., Marion.

A meeting of this board will be called in the near future.

Under the membership contract each firm is to pay one-third of a cent per ton on sales of all stone except fluxing stone and ballast, starting with the 1917 production. Payments are to be made in such amounts as may be called for from time to time by the board of directors. Membership insures eligibility for membership in the National Crushed Stone Association and participation in the publicity program that will be carried out in conjunction with the Wisconsin association under the supervision of Secretary Scherer.

A. P. Sandles, secretary of National

MEN AND MACHINERY

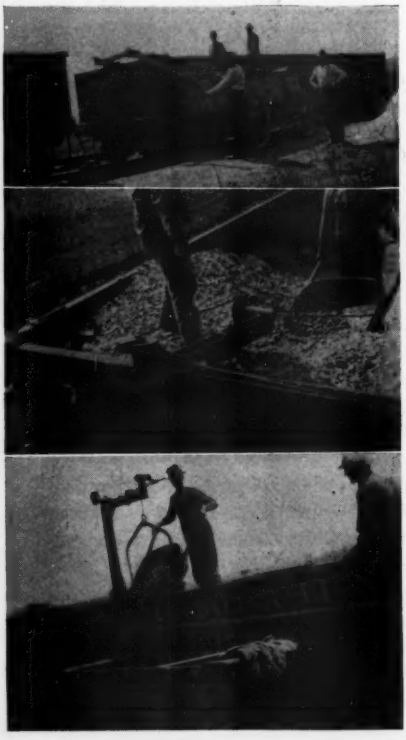
New Unloading Device

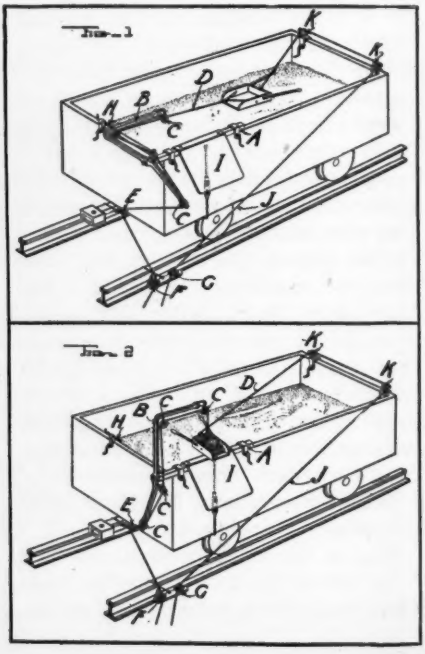
A TIMELY INVENTION is the Yearwood device for unloading railway cars and barges. The pictures show it in detail and in operation. Its inventor is J. R. Yearwood, of the Bluffton-Lewisburg Stone Co., Lima, Ohio. Mr. Yearwood, with T. G. Harris as secretary, is manufacturing the unloader under the firm name of Yearwood-Harris Unloader Co., Lima, Ohio. Another type of machine, to be operated by gasoline power, is under way and will be placed on the market soon.

The unloader is simple, inexpensive and said to be highly efficient. A horizontal supporting bar (A) is clamped on the upper edge of a car body or barge, the outer end extending beyond the body and supporting a vertical swinging lever (B) fulcrumed between its ends. One end is directed laterally to overlie the body of the car or barge, and the other end inclines downward. Each end and the two angles between them carries a sheave (C) to carry the cable (D) attached to the bucket-scoop.

The other end of the cable passes around a pulley (E) anchored to a rail and another pulley (F) secured to the opposite rail and continues to any pulling means such as a windlass or a snatch team. In the case of a barge it is necessary to attach the pulleys to other appropriate parts. The pulley G is also mounted on the same block with pulley F. Its duty will be explained later.

As shown in Fig. 1 lever B is in horizontal plane, with its lateral-directed end resting upon the upper edge of the car body and held in position by the bolt H, also clamped to the car. When the cable has been pulled to the re-





NEW PLANT OF THE DUPLEX TRUCK CO., LANSING, MICH.

quired extent to load the scoop and draw it to the end of the lever a trip-button on the cable releases the automatic latch so that a further pull upon the cable will move the lower end of the lever to a vertical position and thus raise the loaded scoop above the edge of the car so that it may be pumped upon a chute (I) which passes the material into wagons or motor trucks.

A second cable (J), one end of which is attached to the scoop and the other end passing around the pulley G, returns the scoop to any desired point in the car or barge. This cable leads to a windlass, the intermediate portion being trained around a pair of guide pulleys (K-K) clamped to the top edge of the car.

The unloader permits of minor changes without sacrificing the principal advantages.

New Duplex Plant.

THE DUPLEX Truck Co., Lansing, Mich., has occupied its fine new factory buildings, just completed. With practically no waste of time the new factory took up the work where the old left off. About 100,000 square feet of additional floor space are thus added, one of the buildings being 402 by 72 feet, and the other 306 by 72 feet. Both are two-story structures.

The company will be able to increase its output in 1918 to about ten times the 1917 production. Duplex trucks to be manufactured during the year just begun will approximate a total value of $13,000,000. Every month three hundred trucks will be turned out.

In appearance, lighting and efficient arrangement the new factory leaves nothing to be desired. The construction is the most modern type of reinforced concrete and steel, faced with brick. Floor arrangements throughout are ideal. The assembly floor is a marvel of efficient arrangement. Every possible precaution was taken in its planning to eliminate lost motion and unnecessary effort.

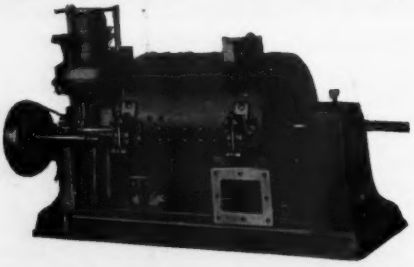
The moving of all materials and machinery from the old Charlotte plant to Lansing was accomplished with Duplex trucks, showing a saving of more than $500. This does not take into account the fact that it would have been necessary to handle the bulky machinery and materials four times, instead of twice had the goods been shipped by rail. In all, 224 trips were made, through eight inches of snow, with an average load of three and one-half tons on the truck. In some cases much larger loads were hauled.

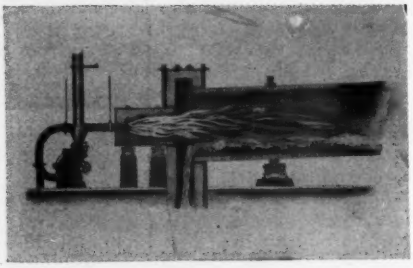
The illuminating engineers of the Edison Lamp Works of the General Electric Company have prepared Bul-

letin No. 43410 containing the latest information as to the correct methods of lighting industrial plants. The Bulletin is well illustrated, showing various lighting schemes most suitable for industrial purposes and the facts are brought out that to conserve the employes' health, save coal, increase the output and to keep the workers contented, it is necessary that a plant or shop be well illuminated according to modern methods.

Coal Pulverizer.

PULVERIZED FUEL combustion is a subject of widening interest. Pulverized coal makes for high efficiency. The Aero machine, pictured here, causes coal to burn like a gas, produc-





ing at will a wide range of temperatures. Each pulverizer operates with a single furnace as a unit and crushes the coal as used. No storage of pulverized coal is required. It handles both wet and dry coal and makes possible the use of low grade or slack coals if they contain 25 per cent or more of volatile combustible.

Each pulverizer runs at constant speed and may be fed by hand or by mechanical devices. The operator's attention is limited to observation of his fire and the regulation of the feed mechanism and air dampers. One operator can attend to a number of pulverizers. It is strongly built, dust proof and arranged for easy repair to the parts susceptible to wear. The discharge is either right or left hand, according to specification. Five sizes are made, handling from 600 to 5,000 pounds of soft coal per hour. The Aero Pulverizer Co., 120 Broadway, New York, N. Y., is the manufacturer. Complete information is given in Bulletin 26.

"Flexible Arm" Shaker Screens.

THE USERS of the G-R-M "flexible arm" shaker screens attribute their satisfaction to perfect cleanliness of the products and the excellence of the grading; these screens also give a very large capacity for the amount of space required. The material is passed through the large perforations first; only the sand and fine gravel ever reach the "deck" with the smallest perforations.

The screens are built with as many "decks" as necessary to give the desired grading of the material. The screening surface consists of heavy steel plate with perforations made to suit the user. These perforated plates can be easily removed and others substituted, when a different system of grading is desired.

A new and clever design of wash water sprays is another feature. The sprays are sharp and cut the dirt off the gravel quickly. The water streams down evenly through all the decks and thoroughly washes all the sizes—"clean as marbles," one man says of the graded materials produced.

Another trouble now overcome was the serious wear on pins and links at the various supports, as well as on the drive. The flexible arm design has eliminated these troublesome features entirely. The G-R-M shaker screens are built very strong to resist the severe service of the gravel washing plant. The Good Roads Machinery Co., Inc., Ft. Wayne, Ind., is the manufacturer.

THE SAN FRANCISCO office of the Blaw-Knox Company has been removed from the Rialto building to the company's new office and warehouse at 528-530 Second street. O. B. Pulis is in charge.

CALDWELL

Machinery for Handling

Stone—Sand—Gravel

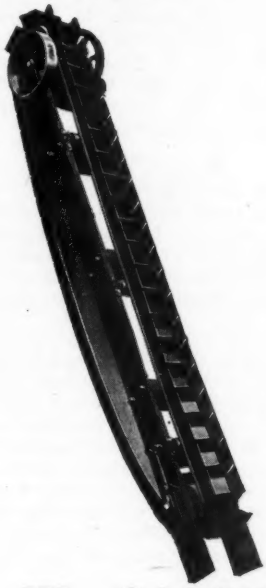
SCREW AND BELT CONVEYORS.

STEEL ELEVATOR CASINGS AND BUCKETS.

GEARS—with cut or cast teeth.

LINK CHAIN BELTING

SHAFTING—Chilled Rim Sprockets.



Upon receipt of specifications, blue prints or sketch, we will be glad to have our engineering department assist you with your Elevating, Conveying and Power Transmitting Machinery Problems.

Catalog No. 38

H. W. CALDWELL & SON CO.

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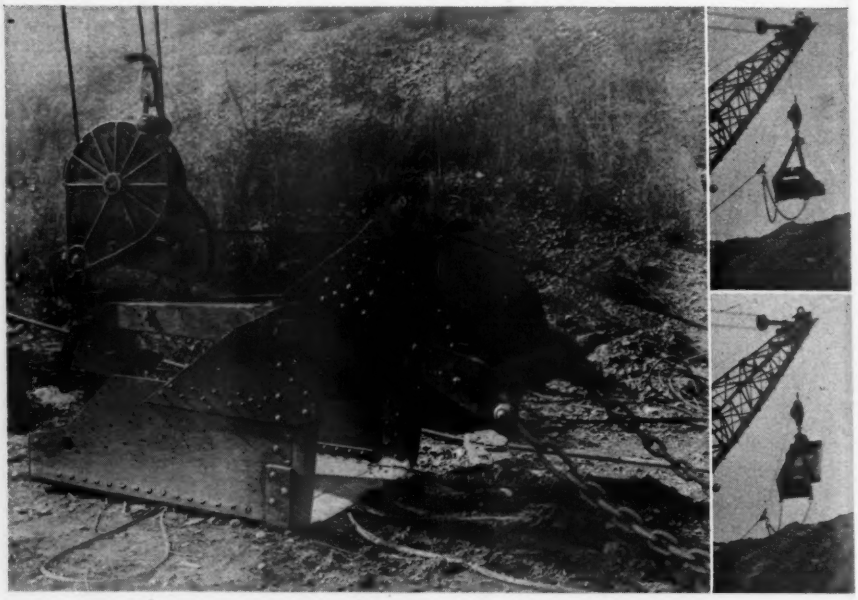
Western Ave., 17th and 18th Sts.



New Type Bucket Has Many Advantages.

H. T. DUNBAR, president of the Dunbar Stone Co., Detroit, Mich., and the Dunbar & Sullivan Dredging Company of Buffalo, N. Y., has designed a new type of excavating bucket. The large picture shows a near view of the bucket and the others show the bucket as loaded and as dumped. The bucket may be termed a drag-clam. The drag line is attached to the chains leading from the door. The door swings on a large shaft. From the door two arms lead off to the hoisting sheave. When the bucket is dumped it swings on the shaft until the dogs on each side of the arms catch and hold the door open. When dropped into the pit and loaded the dogs release themselves, and by hoisting the door closes.

These buckets were used by the dredging concern on its Barge Canal contracts at Waterford, N. Y., and gave complete satisfaction. They loaded in the length of themselves, did not have to be dragged to the bank, and when the door closed the load was held, always loading to capacity and did not bail water. The company states that the buckets gave a decided saving in cables and less coal was needed in their operation. They are of three cubic yards capacity. The near view of the bucket shows the hoisting, dragging and dumping rigging.

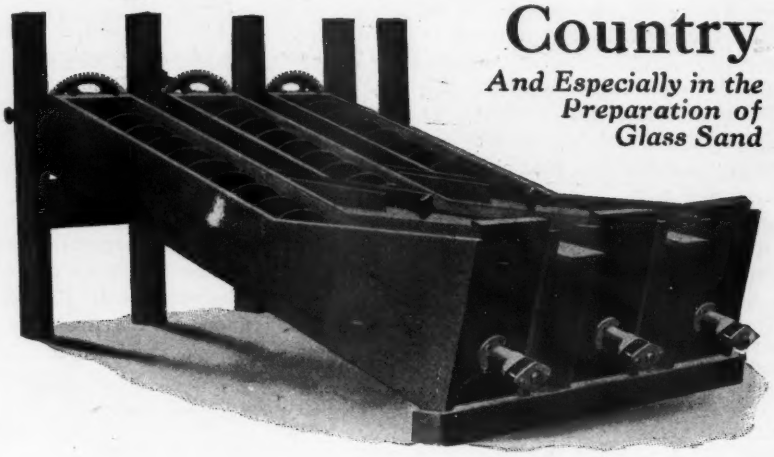
H. D. WRIGHT, manager of the San Francisco office, Brown Hoisting Machinery Co., has been appointed representative of the company for the Northwest territory, succeeding the Colby Engineering Company.

THE ORENSTEIN-ARTHUR KOPPEL CO., manufacturer of dredging and grading machinery and light railway equipment, is building a new plant at Koppel, a new industrial center which is developing just north of Pittsburgh. The Koppel Land Co., a subsidiary of the manufacturing company, is handling the land and housing developments of the new town.

Grace Motors, Limited, with headquarters in Toronto, and branches in the principal cities of the Dominion, is now the Canadian distributer for the Sterling Motor Truck Company, of Milwaukee, Wis.

Used in Some of the Largest Quarries in the Country

And Especially in the Preparation of Glass Sand



LEWISTOWN
Sand Washers

These are reasonably priced, well built, compact outfits, which can be easily and quickly installed. They are simple in construction and efficient in operation. Extensively used in the manufacture of glass sand which is so much needed today in the making of optical lenses for field glasses, telescopes, etc., required by the Government.

If you are not acquainted with Lewistown equipment and service, it will pay you to look into it.

We are in position to assist you solve your problem of whatever nature, if it pertains to crushing, grinding, screening, washing, drying and conveying, as we manufacture a full line of this machinery and equipment. Drop us a line stating what you desire information on.

Lewistown Fdy. & Machine Co.

LEWISTOWN, PENN.

association, was present and explained conditions affecting the industry as they exist in Washington. He is in constant touch with department heads there and will represent the crushed stone industry at a meeting July 10 in the office of L. W. Page, Director of Public Roads, for the purpose of discussing the recent freight rate increase.

R. W. Scherer, secretary of the Wisconsin association, also took an active part in the meeting, particularly in the discussion of the publicity work to be started soon.

The following firms were represented personally or by proxy and will be members:

Casper-Stolle Quarry & Construction Co., E. St. Louis.
Charles Stone Co., Marion.
Superior Stone Co., Chicago.
Illinois & Argo Stone Co., Chicago.
Dolese & Shepard Co., Chicago.
United States Crushed Stone Co., Chicago.
Columbia Quarry Co., St. Louis, Mo.
Artesian Stone & Lime Works, Chicago.
Universal Crushed Stone Co., Chicago.
Belvidere Stone Co., Belvidere.
Elmhurst-Chicago Stone Co., Elmhurst.
A. C. O'Laughlin Co., Chicago.

Concrete Institute.

THE AMERICAN Concrete Institute was in session June 27-29 at the Hotel Traymore, Atlantic City, N. J. An added feature this year was several papers on the subject of concrete ships. A moving picture of the launching at San Francisco of the 4,500-ton ship "Faith" was shown.

Cement Association Meets.

FIFTY-FOUR members of the Portland Cement Association met at the Blackstone hotel, Chicago, Ill., May 20-22, the occasion being the usual spring conference. Two new members were reported — the Wellston Iron Furnace Co., Jackson, Ohio, which recently purchased the plant of the Superior Cement Co. at Ironton, Ohio, and the Cuban Portland Cement Co., of New York.

Ohio S. and G. Meeting July 10.

AMONG OTHER interesting things taken care of at a meeting of the Ohio Sand and Gravel Producers' Association at Columbus June 5 was the adoption of a resolution on the then proposed freight rate increase, which is reproduced on another page.

The association took the necessary steps to become an incorporated body not for profit under the laws of Ohio.

Executive Secretary Guy C. Baker is counting upon a big attendance at the next meeting, July 10, at The Breakers hotel, Cedar Point, Ohio.

Trade Literature.

F. R. PATCH MFG. CO., Rutland, Vt. Several circulars showing pictures with brief descriptions of copers, rubbing beds, saws, planers, jointers, lifting jacks, lathes, drills, polish machines, diamond saws and carborundum machines, floor surfacing machines, etc.

H. B. SACKETT SCREEN & CHUTE CO., Chicago, Ill. Catalog 31, describing mine ore and industrial cars, and elevators, screens and buckets; 7x10 in., 66 pages, illustrated, two colors.

THE TROW AND HOLDEN COMPANY, Barre, Vermont. "Barre Stone Working Tools"; 6x9 ins., 76 pages, 3 colors, illustrated. Describes pneumatic hammers and parts of surfacing machines, hand cutting tools, sharpeners' tools, supplies, etc.

THE SALES FORCE of the Lakewood Engineering Company held a very enthusiastic and successful meeting at the main plant in Cleveland the first week in June. Sales representatives from all over the United States gathered together and discussed with the sales, production, purchasing and engineering executives the present day problem of serving the construction and industrial fields. Over 100 attended the daily sessions and the Lakewood spirit of co-operation, service and good fellowship was ever present.